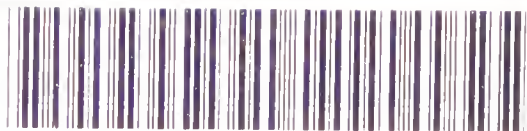


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The Relief and Cure

of

Spinal Curvatures



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THE RELIEF AND CURE
OF
SPINAL CURVATURES.



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THE RELIEF AND CURE OF SPINAL CURVATURES.

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&c., &c.

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PREFACE.



THE following pages have been written for the General Practitioner by a General Practitioner, in the hope that they may aid in the simplification of the treatment of Spinal Curvatures, and help in the clearing away of many of the mysteries which have previously surrounded the subject. They are not written to advocate any one special method of treatment, but to give the indications for, and show the place of, the different systems which are in vogue at the present time. They represent the author's own experience, and the illustrations are taken only from photographs of cases which have been under his personal care.

PERCY G. LEWIS.

22, MANOR ROAD,

FOLKESTONE.

June 1, 1897.



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FIG. 1. Early Case of Lateral Curvature to the Left.

Frontispiece.

THE RELIEF AND CURE OF SPINAL CURVATURES.

CHAPTER I.

ETIOLOGY AND PATHOLOGY.

Introductory Remarks on Anatomy and Physiology—Functions of the Intervertebral Discs—Movements of the Spine—Centre of Gravity—Formation of the Curves—Predisposing Causes of Curvature—Overgrown Children—Nutrition and Muscular Development—Food Fads—Mechanical Causes—Bad Positions—Amesiality—Influence of Flat Foot—Rotation—Influence of Gravity—Evil Effects of Scoliosis—Anatomical Changes—Classification of Curves—Backache.

It is unnecessary in discussing lateral curvature, to enter into the minute anatomy of the spine. There are, however,

a few anatomical and physiological facts to which it would be as well to first draw attention.

The spinal column forms the main support of the head and trunk, and acts as a protective covering to the spinal cord and its membranes. It consists of thirty-three vertebræ, twenty-four of which are separated by discs of fibro-cartilage. The lower nine are joined together to form two bones. Five unite to form the sacrum, and four compose the coccyx. The upper twenty-four occupy respectively the cervical, dorsal, and lumbar regions. Each vertebra consists of a body, an arch, and five processes. Two of the processes are for articular purposes, and the remainder are for the attachment of muscles. The surfaces of the bodies have elevated rims which project in front and at the sides. The bodies and discs are joined together by ligaments, the whole column being ensheathed in a continuous layer of white fibres intimately associated with the peri-

osteum. These, where thickened in front and behind, are called the anterior and posterior common ligaments, the latter being in the spinal canal. The spaces between the laminæ are filled in by short elastic ligaments, and the spinous processes by ordinary fibrous ones.

The discs are useful in adding elasticity to the spine, and, by acting as buffers, enable it to withstand shocks. The united thicknesses of the discs form from one-fourth to one-fifth of the whole height of the column. They are highly compressible, but possessing considerable elasticity in their normal condition, they soon return to their normal shape when the compressing force is withdrawn. The normal curves of the spine are nearly entirely maintained by the presence of the discs, and the difference in height of a person which is said to exist between the morning and evening measurements, is believed to be due to compression of the discs by the weight which the spine has to carry.

The erector spinæ muscles which oc-

cupy the sides of the spine, and are inserted into the spines and transverse processes, take a great part in preserving the equilibrium. They can impart lateral antero-posterior or rotatory motion to the spine. The longissimus dorsi muscles which are attached to the angles of the ribs are also powerful rotators.

There is only very slight movement between any two vertebræ, but the sum of the movements of all the joints is of considerable amount. It can be immensely increased by early acrobatic training. The most movable part is at the junction of the twelfth dorsal with the first lumbar vertebra. It is consequently the most liable to strain or injury.¹ It is by the mobility of this junction that acrobats succeed in gaining most of their marvellous increased range of movement.

The centre of gravity of the body passes from the odontoid process through

¹ McClellan.

the front of the body of the second dorsal vertebra, middle of the twelfth dorsal, and through the border of the last lumbar. Owing to the greater weight of the viscera on the right side, the line of the centre of gravity is a little to the right.

At birth the cervical and lumbar curves are absent. They are secondary or compensatory curves necessary to the upright posture. The dorsal and pelvic curves are however formed before birth to make room for the thoracic and pelvic viscera. The curves, like the discs, increase the elasticity of the column, and also the power of withstanding shocks; they are seldom fully formed until adult life is reached. In most young children there is a certain amount of kyphosis, but the kyphotic condition is one which is naturally assumed at any period of life, if an individual is very feeble or fatigued. Habit or occupation may confirm this initial tendency. The lumbar curve only begins to form when walking and

standing are commenced. Then the action of the psoas and iliacus comes into play, and acts powerfully in producing the anterior lumbar curve. Most authorities agree that there is a normal curve to the right in the dorsal region, due to the greater use of the right hand. From a study of the various games and occupations mentioned in Chapter VI., this indeed seems probable.

Tubby, in his "Treatise on Orthopædic Surgery," points out that the movements of the spinal column which take place in all directions are more limited than is usually supposed, especially so rotation and lateral flexion. These are supplemented by the free play of the pelvis on the heads of the thigh bones, and by the amount of tilting of the pelvis possible without disturbance of the equilibrium. There is most movement in the cervical and lumbar regions, but in the dorsal region the overlapping of the laminæ and the attachment of the ribs give more fixation of the vertebra. The spine can bend

forward most in the lumbar region, and backwards most in the neck. Rotation, apparently very great in the neck, mostly takes place at the atlo-axoid joint, but is greatest in the dorsal region, owing to the direction of the articular processes. Rotation in the neck is necessarily combined with lateral flexion, giving rotation round an oblique axis.

It will be as well now to pass on to the subject under consideration, leaving other anatomical and physiological facts for discussion as occasion arises.

It is a generally accepted fact that curvatures of the spine are due to "weak muscles," but the causes of the muscles being weak, and the mechanical results to which those weak muscles give rise, are not so generally recognised.

In very young children rickets and allied conditions are most potent causes of curvature. The rickety contortions of the spine are usually supposed to be quite distinct from lateral and other curvatures. The difference however lies

chiefly in the rapidity of the changes, and in the fact that the bony changes occur earlier rather than later. The allied conditions of general weakness are malnutrition, anæmia, want of fresh air and exercise, chronic dyspepsia, menorrhagia, and almost any depressing influence. These, though to a less extent than rickets, practically favour the abnormal results of the mechanical causes which are discussed later on.

It is remarkable that curvatures, except when they occur in very old people, appear almost entirely during the period of growth. It most commonly happens that a curvature is first noticed at those periods of life when growth is proceeding most rapidly, viz., from 5 to 7, and from 12 to 17 years of age. From this it is evident that some defect in nutrition is the root of the evil, and taking the fact that the disease is much more common in girls than in boys, one is led to the conclusion that it must be some error in the surroundings or mode of life which



FIG. 2. Case of Curvature from Carrying Child on Right Arm.



causes this defect in nutrition. Because all the girls in a school do not suffer from curvature, it must not be supposed that the conditions of school life are perfect. Every day one sees examples of good constitutions being able to withstand indefinitely adverse conditions, fatal to those of less robust bodies.

From the examination of a number of cases, it is found that curvature is most common in those individuals who are generally described as "overgrown," *i.e.*, who are for a given age above the normal size and height. In connection with this fact one is reminded of the rapid growth of a potato plant in a cellar. The potato plant is there under certain conditions of growth, but not under the normal conditions. It is the same with the child when overgrown. She (or he) is not under the normal conditions. The chief characteristic then is a deficiency of muscle. The efforts of nutrition seem to have concentrated their force on quantity

rather than quality. As with the potato in the cellar, so with the child, this result is mostly brought about by absence of fresh air and light. To give a child fresh air and light in sufficient quantity, of necessity entails muscular exercise. The result of the long indoor hours to which children are often subjected, especially at home, is *feeble muscular development*.

Glancing for a moment at the physiology of muscles, one finds that the muscles have a very important *rôle* in the organism in connection with both heat and nutrition. As regards heat they have been called the furnaces of the body, and they have been estimated to produce about four-fifths of the heat necessary to maintain life. If the muscles be feeble the temperature is subnormal, and nutrition is thereby depressed. Further, without muscular exercise, respiration and circulation are slowed, and therefore the respiratory and circulatory organs are badly developed.

The muscles, too, have important functions in connection with the assimilation and conversion of food within the body. They help, also, in the elimination of waste products.

In the want of muscular development and its results exist important causes of defect of nutrition. The two things, then, work round in a vicious circle. Defect of nutrition is a cause of undeveloped muscles, and undeveloped muscles are a cause of defective nutrition. But it is not likely, nor is it a fact, that one tissue only would suffer from the abnormal environment; all the other tissues of the body must suffer directly as well as indirectly. The sight is often defective; there is little mental energy; the patient suffers from anæmia, rheumatic neuralgia, the so-called "growing pains," dyspepsia, and very commonly menorrhagia.

Weak muscles mean, too, weak bones, and weak bones involve weak ligaments. The big bones are soft and spongy, and are easily bent or moulded gradually

by the constantly applied pressure of bad positions ; the ligaments are soft and easily stretched by the same cause. The whole body is in fact "jerry built." Not only is the whole structure without strength, but the physiological white-washing, painting, and papering are badly done, and the sanitary arrangements are defective.

An interesting fact, too, is that these patients have often been allowed to acquire fads about their food. The majority of these faddists will not touch meat except under compulsion ; others evince the same kind of aversion to green vegetables or milk puddings or fat. Nearly all of them are small water drinkers, a fact which is probably explained by their low body temperature and defective nutrition.

Although a very large proportion of curvatures occur in these over-grown children, it must be distinctly understood that it is not only these "jerry built" children who suffer. Curvature is also to be found in the stunted under-



FIG. 3. Author's Vertical Meter
in Position.



FIG. 4. Artificial Amesiality
produced by placing a
book under Left Foot.

grown children with defective nutritions. In these, however, the levers through which the mechanical causes act on the spine, are shorter and consequently the causes are less effective. The mechanical causes may, however, be so powerful as even to cause a curvature in individuals of robust constitution. Such a cause, for instance, as the habitual carrying a load on the one arm. Fig. 2 is the back of a young nursemaid who for several years had been in the habit of carrying a heavy child on the right arm. The result is a rotatory deviation of the spine bringing the right shoulder backwards and making the spine convex to the right in the dorsal region, and convex to the left in the lumbar.

Passing to the mechanical causes, there is one fact which, though obvious, is often lost sight of. It is that a weak spine deviates from its normal position *chiefly because it is weak*, just as a willow stick inclines one way or another, when a brass rod of the same diameter would remain erect. The weak willow stick

gradually becomes permanently bent in one direction or another, according to the direction of the most constantly acting force. In the case of the willow stick it is the influence of light or wind. In the case of a weak spine, it depends on the positions in which the spine is mostly maintained ; not, as is usually taught, in positions of rest, but in positions of muscular activity. For instance, the bad positions which are held up as examples, are mostly positions of rest, *e.g.*, such positions as lounging in chairs, leaning on an elbow while writing, &c. They are positions so universally adopted that spinal curvatures should become the rule, and straight spines the exception. A very young infant has a nearly straight spine, and the adult normal curves are the result of the normal action of the muscles on it. A curved spine is, therefore, the result of the abnormal action of the muscles upon it, and this abnormal action has its first cause in abnormal muscular weak-

ness, in other words, spines are bent by muscular contraction and not by muscular rest.

Standing is a position of muscular activity, but lounging in a chair in however a bent position is one of muscular rest. In taking photographs of his curvature patients, the author frequently found that the negatives indicated that the camera was not straight. He was in consequence led to rule a line down the centre of the ground-glass screen of the camera. By keeping this vertical through the centre of the image he hoped thus to obtain vertical negatives, but the results appeared even worse than before. From this he suspected that the patients themselves were out of the vertical. To demonstrate this the instrument figured has been devised. It consists of vertical and horizontal rods ; the vertical stands on three feet, of which the longest passes out at right angles to the vertical. It projects between the patient's heels, while the vertical appears above the

patient's head. It is then only necessary to connect the two by a straight line on the photograph to find the vertical, or a plumb-line may be dropped from a horizontal rod coming from the top of the vertical parallel to the projecting foot, if long enough, it will of course touch it.

Examined in this way, it is found that in even early cases of spinal curvature, the vertical up from the heels does not pass through the centre of the head, frequently in marked cases, not through the head at all; see figs. 3 to 9. The muscles are not strong enough to hold the spine straight and it consequently deviates. This deviation of the spine in the erect position, shifts the position of the centre of gravity so that one leg has to bear more of its weight than the other, and in consequence determines which leg is chiefly used for standing on. In fact, it is the weak muscles which cause the bad position.

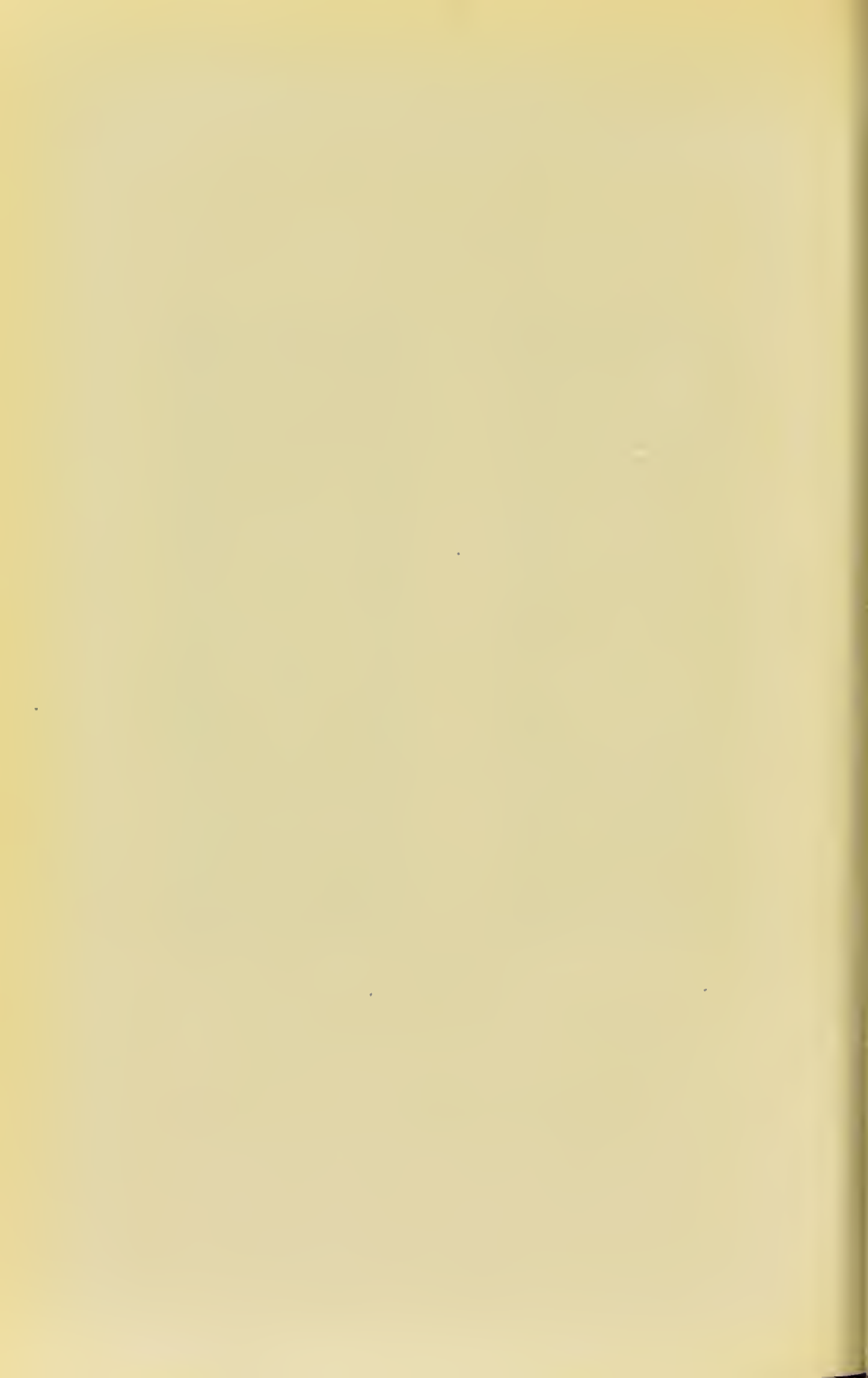
On account of the greater weight of the viscera on the right side the deviation most commonly takes place to the



FIG. 5. Case of Curvature showing Amesiality.



FIG. 6. Back View of same.



right, causing on that side a lumbar concavity and dorsal convexity. The normal right dorsal curve also aids this result.

Mr. Brodhurst has stated that 95 per cent. of spinal curves are caused "from below." If the facts and the line of reasoning here adduced be correct, curvatures do not come "from below" but from above. Mr. Barwell has described the same condition under the name of the "amesial pelvis," but he has missed the fact that the whole body is "amesial" including the head, and has figured an advanced case of curvature with the vertical passing through the centre of the head to midway between the heels. It may be possible to assume this position voluntarily, but it is certainly not an unconscious position.

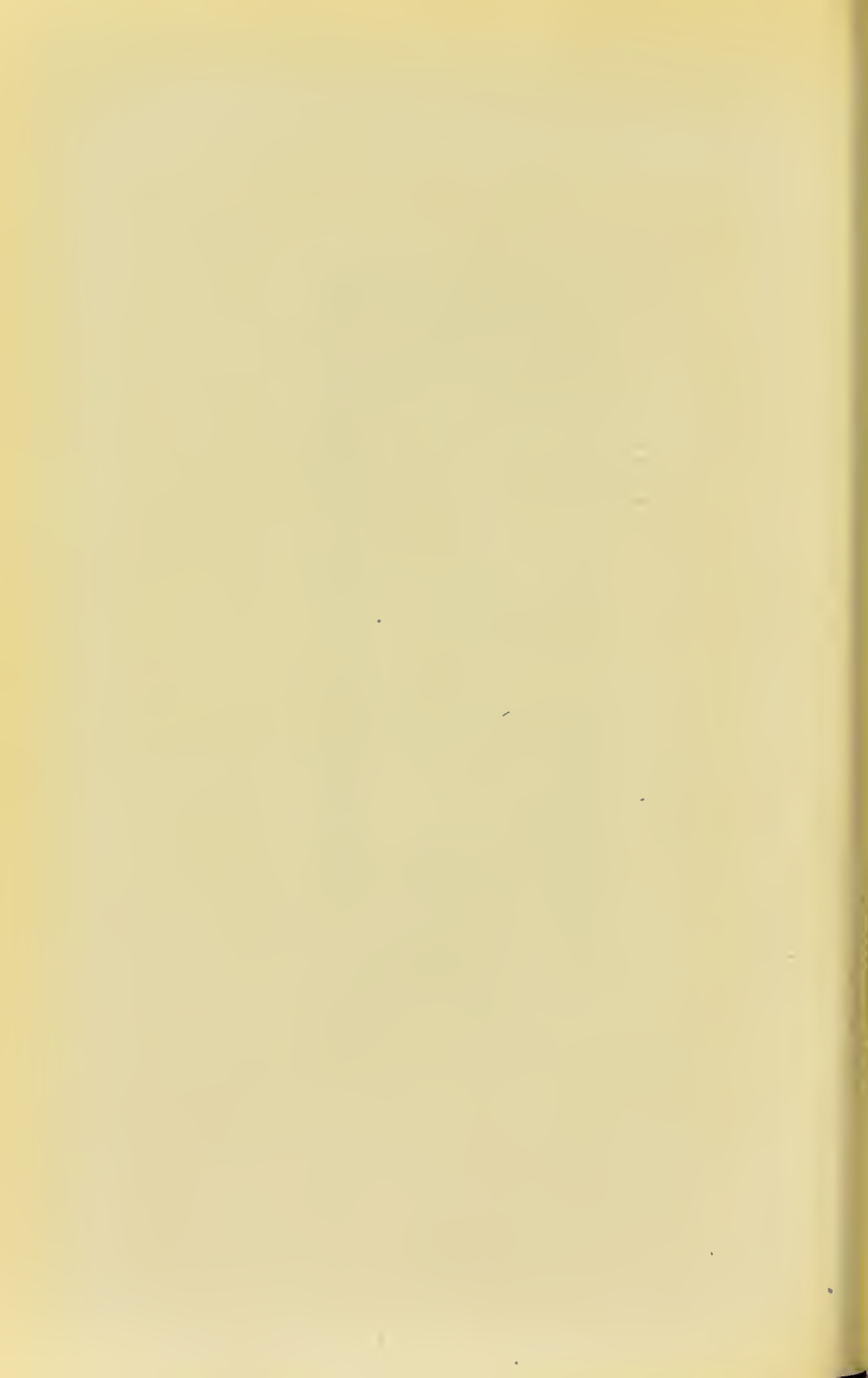
One of the results, if nothing else interferes, is that the pelvis becomes tilted up on the side to which the deviation has taken place. This causes at once a curvature with lumbar concavity towards

the deviated side. If the deviation is small a single curvature will result, if large, a double. Without treatment a small deviation tends to become a large one, because the equal action of the muscles of the two sides of the body is now interfered with. Not only are the muscles weak, but they are now acting at a disadvantage all the way up the spine. The broader the pelvis is the greater will be the tilting. This fact is doubtless one of the causes which determine the greater frequency of curvature in girls than in boys. This must also be taken in connection with the fact that curvature most commonly occurs between the ages of 12 to 17, just the age when the pelvis is enlarging. Any surgeon who keeps photographic records of his cases, will at once recognise the fact that the vast majority of his photographs are of young women between these ages. Very few are of boys and children below this age.

The result of this deviation from the vertical of the whole body, causing one



FIG. 7. Case of Left Lateral Curve showing Amesiality.



leg to bear more of the weight, is to cause flat foot on that side. That is to say the deviation or *curvature of the spine causes the flat foot*. It is not as generally taught that flat foot causes the curvature. The flat foot is distinctly secondary as a rule to the spinal deviations. If the weight alone caused the flat foot, it would be equal on the two sides. If habitual standing on one leg were the cause, one would expect to find hypertrophy of the muscles of that leg, a fact which has not yet, to the writer's knowledge, been observed. It may possibly be the reverse sometimes, but can hardly be common if the arguments and facts here adduced are accurate.

In using the vertical meter, it is quite a common thing to meet with cases in the very initial stage which deviate from one side to the other quite independently of any rule ; the patient, in fact, sways to and fro while under observation. The muscles cannot hold the spine straight, but have either not yet become suffi-

ciently weak, or there has yet been no definite cause of sufficiently constant action, such for instance as a difference in length of the legs, to determine the deviation being always on one side. All those who are constantly examining spinal cases carefully, know how frequently it happens that the legs are measured and found absolutely equal, and yet one iliac spine is found to be higher than the other. These results are generally ascribed to inaccuracy of measurement, the presence of flat foot, genu valgum, or rickety curves of the bones. Still all these, except flat foot, should be present in the horizontal as well as in the vertical position, and gentlemen who would not think of impugning their own accuracy in measuring in a case of suspected hip joint disease, do not mind doing so in a case of curvature. The author would contend that these are cases of amesiality, and that they would be found to be so if examined with his vertical meter.

When flat foot has formed it does

not tend to correct the curvature by bringing down the raised hip, because, on the contrary, the bringing down the raised hip simply increases the amesiality.

And so it is with each stage of the complaint—each addition to the deformity is a fresh cause of amesiality, tending to increase the already present curvature, which, it need hardly be pointed out, necessarily involves the passage of the centre of gravity of the body away from the middle line. The spine, therefore, instead of being arranged on the vertical passing through the centre of gravity, tends to arrange itself to one or other or both sides of it. It makes, in fact, a single or double curve, and the higher one goes in examining the spine, the more the forces above tend to act, as, of course, they must do with a longer lever. But new forces, as will be shown, also come into play.

Let the reader consider for a moment the muscles which support the spine laterally. If a strong muscular person

is passively bent from one side to the other, the muscles on one side become slackened and on the other stretched. If he then be told to walk away, the stretched muscles very soon pull him straight again. But if the muscles were weak and the spine were always bent, the stretched muscles would become permanently elongated and the cramped muscles permanently shortened. Not only then is the spine bent but a powerful obstacle to cure is interposed.

The spine, however, has not only to be kept from deviating laterally by muscles, but it has also to be kept by muscles from deviating antero-posteriorly. Many of the muscles which prevent the spine deviating laterally also have a share in preventing it deviating antero-posteriorly. At the very outset then there exists a force tending to cause rotation, viz., the unequal muscles on the two sides of the spine and ribs. Thus the chief force which keeps the spine straight is interfered with, viz., the equal action of the



FIG. 8. Example of Amesiality from Difference in Length of Legs.



muscles of the two sides ; on the one side are weak muscles, on the other strong. The strong soon overcome the weak, which thus become permanently stretched and lengthened. A strong force is soon at work, constantly tending to rotate the vertebræ and so increase the curvature. And what is true of the erector spinæ and its continuations holds good also for all the other muscles which take part in keeping the spine straight.

But before discussing this it will be well to consider for a moment the treatment of another complaint which has a bearing on the treatment of scoliosis, viz., the deformities which arise from infantile paralysis. The treatment of these the author first learnt from Dr. Robert Jones of Liverpool. The principle involved, which has already been touched upon, applies also to other deformities. In the case of paralysis of the extensors of the wrist from infantile paralysis, generally a considerable proportion of the muscular fibres recover ; but during the time they were

weakened, or *hors de combat*, the unaffected flexor muscles so easily overcame them that the extensors became over-stretched and the flexors shortened. When the attack is over, any contraction of the extensors is too feeble to overcome the strong flexors, and has very little or no effect beyond pulling in the slack. If, however, the action of the flexors be eliminated by forcible further flexion of the wrist, the extensors are pulled out to their full length, and any little contraction they may be capable of is shown by movements of the fingers. If these movements of the fingers take place, it shows that recovery is possible. The first point in treatment is to restore the natural relation as to length between the flexors and extensors. This is done by putting the forearm and hand up in a splint in such a way that the extensors are slack and the flexors stretched, *i.e.*, the hand is half extended. The extensors, being now unopposed, shorten, and the flexors lengthen. Gradually, as this takes

place, the amount of extension is increased until the strong flexors are slightly longer than natural and the extensors shorter. The splints are now taken off daily for various muscular exercises, and the limb gradually becomes restored to usefulness.

In cases of scoliosis, though the surgeon has not often to deal with paralysis, yet he has to do with extremely weak muscles. For many reasons to be mentioned later, it is not often advisable to put these cases in splints, so he has to make his exercises produce the same result, viz., to shorten lengthened muscles, and lengthen shortened ones. In stooping, the abdominal muscles are shortened. The exercises should therefore be chiefly of the opposing back muscles.

To sum up, then, it has been shown that there are powerful forces acting in individuals with weak muscles, some tending to produce lateral deviation, others tending to produce antero-posterior deviation of the spine. As a

result of these acting unequally the spine rotates. It is well known that the bodies of the vertebræ rotate more than the spines, and this fact has been explained in very many mysterious ways too numerous to mention. The fact is, however, capable of very simple explanation; it is nothing more than a question of the difference in length of the arms of the levers by which the rotatory forces are transmitted to the vertebræ. The rotatory forces, *i.e.*, the unequal action of muscles, act through the spinous and transverse processes, which are the levers. The fixed points are the articulations of the articular processes. If any vertebra be measured forwards and backwards, it will be found that more of the vertebra is in front than behind. It is behind that nearly all the muscles are attached, *i.e.*, they act on the vertebræ from the shorter side of the fulcrum. Therefore the longer arm, *i.e.*, the body, must be moved through a greater arc than the shorter. Again, the

super-imposed weight of the shoulders and arms is best borne with the shoulders well back, *i.e.*, with the centre of gravity of the shoulders as near the vertical axis of the spine as possible. If it is too much forward, owing to stooping, or the clothes being too tight in front of the chest, it tends to produce kyphosis in a person with a straight spine, equal legs, and equal erectores spinæ. When the weight of the shoulders falls forwards, the contraction of the erectors prevents it going too far. If the erectors act equally, the two shoulders fall forward to an equal extent, but if one is stronger than the other, the shoulder of that side does not fall forward as far as the shoulder on the side of the weaker erector, that is to say the spine becomes twisted. Thus stooping is a very active cause of scoliosis. As a proof of this is the fact that when examining a case the patient at first does her best to stand erect, and it is then often impossible to see that a curvature exists. If however, the

patient is kept standing while the surgeon engages in conversation with a by-stander, the weaker muscles become tired first, relax, and the curvature becomes apparent.

When the immense forces which act in the direction of twisting the spine when once a slight curvature has formed are taken into consideration, the necessity for early treatment becomes at once apparent.

What has been said about the influence of the weight of the shoulders in producing scoliosis, equally applies to the weight of the head. The line of the centre of gravity of the head also passes a little in front of the axis. Consequently the head of a person with weak muscles tends to poke forwards, and thus to alter the normal central curve. This has a greater or less effect on the curves below. If there is rotation below, there will also be rotation above from the muscles on one side acting at a disadvantage, or from their being definitely altered in length.



FIG. 9. Amesiality from Knock-knee.

But these weights, viz., the shoulders and head, not only act in causing rotation and kyphosis, but they also help to keep up lateral bending when once it has begun. Let the reader imagine two sticks of the same diameter, one straight and the other bent. It may be possible to bend the straight one by pressing on the end, but how much easier to bend the already bent one. It is the same with the spine. The weights of the head and shoulders are easily borne by the normal spine, but a bent one becomes more bent.

Real lateral curvature independent of twisting may be present with or without twisting, as twisting may be present with or without lateral curvature. Besides the changes in the spine, scoliosis has other effects on the bony skeleton. It causes separation of the ribs, convexity and enlargement of one side of the chest, approximation of the ribs, concavity and contraction of the other. Enlargement of the chest on one side causes elevation of

the shoulder of that side, contraction of the other causes depression of the shoulder of that side. Elevation of the shoulder and separation of the ribs increase the distance of the edge of the scapula from the spine, depression of the shoulder and approximation of the ribs lessen the distance. Besides the alterations which occur in the relation of the chest and spine there are others which occur in the pelvis as the result of stooping. When a patient stoops, this action is followed by a tilting forward of the pelvis. With habitual stooping there is an habitual pelvis tilting. The muscles on the front of the thigh become shortened and weak from being little used in balancing the pelvis, while those behind become lengthened and strengthened because the chief work in preventing the trunk from falling forwards is then done by them. The pelvis is therefore tilted forwards as well as sideways.

There are certain results which follow spinal deviations, especially the scolio-

tic ones. Thus one hip becomes prominent from the shoulder of that side being drawn back, and the separation of the ribs on the convex side causes the shoulder to be pushed up and be more prominent. These two symptoms are often the first to be noted by the friends of the patient. Another result is alteration in the shape of the flanks, one becoming more convex and the other more concave. The points of greatest incurvations on the two sides are no longer opposite each other forming the waist, but are lowest on the side of the lumbar concavity. One result of this is that the waist-band of the patient's dresses will not remain horizontal but falls on one side. This growing out of the hip or shoulder, and the slanting of the waist-band are often first drawn attention to by the tailor or dressmaker. This fact is often the first reason for consulting a surgeon. The author has more than once found young ladies refuse to continue treatment as soon as their waist-bands would re-

main level, although in his opinion treatment should have been kept up until every trace of the spinal deviation had disappeared.

By deviation the spine loses in vertical length, and therefore the patient loses height. This fact accounts for the gain in height of an inch or more so frequently noted as one of the first results of treatment.

After a longer or shorter time, changes in the inter-vertebral discs tend to occur. The line of greatest pressure being on the concavity of the curve, the discs on this side are subjected to more compression than those on the other. Finally they tend to get absorbed and the vertebræ become fixed together, becoming thinner on the concave and thicker on the convex side, until in section they present a wedge-shaped appearance. The arches, transverse and spinous processes, also suffer changes, the result of the different effects of the muscles on them on the opposite sides. In order to help the muscles on the convex side to

act to better advantage in their efforts to straighten the spine, these processes become lengthened. For the opposite reason they become shortened on the concave side. The articular processes on the convex side enlarge for the same reason, and also because there is a greater range of possible movements on the convex than on the concave side.

The ligaments follow the changes in the bones and muscles, and are shortened or lengthened accordingly. Muscles and ligaments may be altered in length, surgically as well as pathologically, by the application of suitable measures, but when the inter-vertebral discs have disappeared and the bones have become fused together, the case is to that extent incurable.

It has been attempted by many to so classify the varieties of lateral and scoliotic curves, that definite and simple rules of treatment might be laid down. The author confesses that he at one time hoped this might be possible. It

is not, however, such a simple matter as one might think at first. The various factors which may cause a curve, and the ways in which these factors may vary, are very large. The possible combinations of curves, too, are very great. For instance, one could conceive many degrees of lumbar curve of different lengths, with more or less twisting and more or less combination of it with a greater or less amount of a lordotic or kyphotic condition. The variations in the lumbar curve would introduce a greater or less amount of compensatory alterations in the dorsal and cervical curves. Half an inch more or less in the amesiality would determine whether there was to be a single or double curve. The different muscles and possible combinations of muscles capable of producing curves from unequal actions are also great. A factor, too, is the strength of the muscles. Thus an inch difference in the length of leg may produce a single lateral curve in a child who is otherwise

well developed muscularly, but in a weakly child will produce an **S** curve. Then there is the special factor as to whether the curve is caused by general weakness only, or whether there is added a cause from above or below, or whether the cause is a more potent one, acting on a person of normal strength, such a case, for instance, as that of a nursemaid, who is always carrying a heavy child on one arm (see illustration), or in the case of persons engaged in one arm employments, necessitating a large amount of muscular force. The three curves may consist of one long and two short, or of two long and one short, or of three of equal length. The fact is, each case has to be steadily worked out separately, to know exactly in what the whole abnormality consists.

But although an accurate pathological classification is difficult, a certain clinical classification is possible for the purposes of treatment. When once the principles of treatment of curvatures, which take their origin

from muscular weakness, have been mastered, the treatment of spinal deviations arising from other causes becomes easy.

It is only necessary for the purposes of this work to mention what the other causes may be. They are as follows :— Contraction of chest after pleurisy, empyæma (Estlander's operation), wry-neck, loss of a limb, hip-joint disease, real difference in length, paralysis of muscles.

There are two statements which are frequently made about spinal deviations. One is that a curvature never remains stationary, but always progresses unless treated. This the author believes to be not quite accurate, as he has several cases under his observation who are not able to give up the time necessary to treatment, but who periodically report themselves. In one there had been no alteration which can be determined by the instruments at his command during four years, in the others there have been no changes for periods ranging from three years to six months. It is only



FIG. 10. Case of Untreated Curvature which has reached the Stationary Period.

fair to say, however, that these cases were at first treated energetically by methods to be afterwards detailed.

The other statement is that rotation cannot exist without curvature. Cases of rotation without curvature have, however, been recorded in the medical journals during the past year, and shown at medical societies. The author has himself seen a case of which the notes have, unfortunately, been lost.

The spine does not possess any more immunity from rheumatism than the rest of the body, and, indeed, is often affected with it when it is abnormally curved. This fact accounts for the frequency with which pain is noticed to bear no relation to the amount of the deformity. Severe pain may be present in slight cases and absent in very bad ones. From what has been said of the general condition of these patients the presence of rheumatism will not be surprising. The pain being often worse at night when going to bed, and the frequency with which it is

relieved by salicin are facts which confirm this view of one of the causes of pain in scoliosis.

The internal organs become more or less affected by spinal deviations even from the first. Thus the habitual stooping which is so active a cause of curvature cramps the lungs, especially the upper lobes, and interferes with free normal respiration. From want of free normal respiration the whole body suffers; still more is this the case when the whole chest has become distorted and cramped and the lung space permanently encroached upon. In advanced cases the heart too suffers interference from displacement either of itself or of the direction of its chief vessels, in addition to the inconvenience which it suffers from the inefficient respiration. Inter-costal neuralgia from pressure on the nerves may occur when the ribs become pushed together.

The abdominal organs suffer in the same way from interference with the chest organs, and possibly uterine dis-

placements have their predisposing if not exciting causes in the direct or indirect effects of muscular weakness. It may here be remarked that the author has frequently been able to relieve his patients from the necessity of wearing uterine supports by substituting a course of medical exercises at the gymnasium.

To the remarks about rickets, one should add that the disturbance of the relative weights of the head and viscera, acting on weak muscles and ligaments, is one factor in producing curvatures in the subjects of that disease.

CHAPTER II.

THE DIAGNOSIS OF SPINAL DEVIATIONS.

Dressmaker Symptoms—Method of Examination—Diagnosis of Rotation—Use of the Vertical Meter — Roth's Scoliometer — Graphic Representation—Use of Photography for Recording Cases — Barwell's Scoliometer—Measuring the Legs—Diagnosis from Caries.

THOSE who have studied this generally neglected subject, will find no difficulty in diagnosing a case. In fact, so obvious does it become to the trained eye that it is easy to see spinal deviations in large numbers at almost any social gathering or public promenade. Very few people, except those who are in the enjoyment of full muscular activity, or who are being constantly drilled, are good examples of the normal spinal curves; many of these are of

course not *pathological* in the sense in which they are being discussed in this work. The influence of wearing high heels to the boots, of lumbago or sciatica, of alterations in the chest from fibroid changes in the lungs and from emphysema, of various employments, and of old age, produces abnormal deviations of the spine and helps to swell the number so obvious to the observant eye.

In very young children, whose spines are very flexible, it is often difficult at first to be sure whether the deviation, changing from one side to the other under examination, is one requiring treatment or not. The history of the case is here the determining point. If the parents have always to complain of the patient's laziness, both mental and muscular, if he is always lounging about and little inclined for outdoor exercise or indeed for exercise of any kind, the case, if not absolutely one of curvature, is certainly one for treatment. If one hears that the patient has to be con-

stantly told to sit up, or "hold up," or "keep his elbows off the table," then an incipient curvature is almost certain. A chronic stoop, or habitual poking of the chin, which we have seen to be active causes of curvature, are also very suspicious circumstances. And here it may be remarked in passing, that these aggravating directions to the patient to "hold up," &c., are really far more potent causes of spinal curvature than the bad positions in which the patient places himself. They are in fact active instead of passive causes of curvature, for the simple reason that the muscles are not strong enough to hold the patient in the wished for position for more than a few moments, and if made to perform a feat for which they are unfit, the consequence is that they waste and thus the cause of curvature is increased.

Next to the laziness and consequent bad positions, come the "dressmaker symptoms" already alluded to, viz., the growing out of the hip and shoulder and

the obliquity of the waist-band. The trained eye will now detect, even when the patient is still clothed, an inequality in the spaces formed by the approximation of the arms to the sides of the body and possibly, too, some abnormality in the poise of the head. So great, however, is the tailor's or dressmaker's art, that even very great deformity is often effectually hidden thereby. Much too may be suspected if the general condition of the patient is such as is described in the preceding chapter.

In order, however to, make a complete and proper diagnosis and examination of a case, the patient must be more or less stripped. In young children, or young men, this should be complete, as this is the only possible way in which the whole deformity and its possible causes can be completely gauged. For obvious reasons this is not possible with girls over fourteen. With the latter one has to do the best one can with the minimum of exposure necessary. At least they must be uncovered well below the hips so as

to show the great trochanters of the femurs. In all cases the boots should be taken off. The patient should stand with the back to the light, the feet close together, and the arms hanging loosely at the sides. Under examination the patients often make the best of themselves at first, but are unable to retain this improved position for more than a few minutes. The muscles soon tire and the real amount of deformity becomes apparent. While waiting for this, the surgeon should, commencing at the top, particularly notice whether the ear-tips are level, if the contours of the shoulders are level and equal, if the spaces formed by the intervals between the arms and the sides of the body are equal, if the scapulæ stand out equally, and if they are at the same level and at the same distance from the spine, and if the two sides of the chest look equal from behind. He should mark the crests of the ilia with ink or aniline pencil to see if they are on the same level. The lumbar region should be examined for inequality of its two halves,

and also the back generally for obvious spasms, or hypertrophy, or atrophy of any particular muscle or muscles. The gluteal folds are also to be noted in the same careful way as in examining a doubtful case of hip joint disease. The patient should now be turned round, and the appearance as to inequality or bulging noted. The knees are to be examined to see if the patellæ are level; the legs for genu valgum. If either of these conditions be found, it must be determined whether it is greater on one side or the other. The feet must be inspected in order to see whether flat foot exists, and a note made as to which side is the worse.

With the patient seated if she be too tall, the surgeon should next look down on the shoulder from above to see if the shoulders are placed exactly above the hips. If rotation be present one shoulder will be found to have been displaced forward and the other backward.

To get a good idea of the amount of curvature of the spinal column as shown by the spinous processes, it is best to feel

for the tip of each process and dot it with ink. When all are marked the curvature, if present, will be very obvious. By marking them in this way a much truer idea is given than is obtained by such means as are generally recommended; such as rubbing down the spine until the skin is made red, or by running two fingers down, one on each side of the spine. The skin is so elastic and movable that the red line or lines do not generally correspond with the spine when the fingers are removed.

The amount of rotation is estimated as follows : the surgeon sits facing the light, the patient stands with her face to the light, *i.e.*, with her back to the surgeon. The patient now bends forwards from the hips, with the hands hanging down as if to touch the ground. She now slowly raises herself from behind forwards; as she does so each pair of ribs stands out against the light, and it therefore becomes at once obvious if any inequality in the two sides of the chest exists at that level.

Though this sounds easy in theory, it requires some experience and constant practice to keep one's hand and eye on the alert to detect the sometimes very slight differences. It is best to commence with a normal individual, and by placing a book under one foot many of the features of a case of scoliosis may be produced. By varying the thickness of the book, different degrees of curvature can be imitated.

The examination should always, however, be completed by examining from that point which the author considers to be the most important in connection with spinal deviations, viz., amesiality. For this his vertical meter will be found most useful. By having the transverse arms ruled in inches and by the use of movable pointers, one can accurately measure how much the spine deviates at different levels from the normal vertical line. This much of it is adapted from Mr. Barwell's admirable instrument described below. By means of a ruled pointer attached to the vertical rod,

movable to different levels and capable of being protruded or withdrawn, the distance of the spine from the vertical rod can be noted at different levels. Those who wish to keep accurate records of their cases should, among other things, keep notes of these distances.

In the treatment of every case a graphic representation should be taken every month as a record of the case. Thus improvement, over-correction, or retrogression may at once be made manifest. For recording cases there are many devices. Making a sketch of the case at the commencement and end of treatment is unsatisfactory, because one might naturally be inclined to make it rather worse than it was at the commencement, and rather better than it is at the finish.

Roth's scoliosimeter gives a fair record when one has become adept at its use, and by putting one tracing over the other and holding them up to the light, any change can at once be noted.

This instrument consists of a strip of

metal, which can be moulded to the chest wall just below the angles of the scapulæ. It is then transferred to a

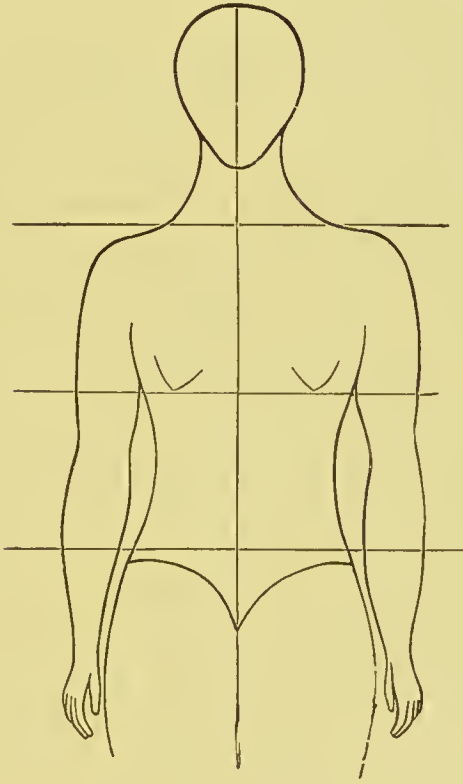


FIG. II.

piece of paper, and a tracing taken on the inside. If the position of the spine and scapulæ be marked on the

strip while it is on the chest, and then marked on the paper, not only can the difference in shape be noted, but the difference in the size of the two sides can be measured.

This instrument gives the horizontal deformity only. To record the vertical, the author, some years ago, had a rubber-stamp made with the diagram represented in fig. 11 on it. This was taken to be the normal, and variations from it were marked thereon in blue pencil. In this way it became possible to very rapidly mark on the elevated shoulder, the deviated spine, as well as the alteration in level of the scapulæ and hips, and the changes in shape of the subaxillary spaces. This method is open to the same objections as sketches, but has the advantage of being more rapid, and to one unskilled in drawing, more accurate.

Some authors have gone so far as to recommend the taking of plaster casts of the back. This is, however, in the writer's opinion, a tedious proceeding,

which takes up much time, and for obvious reasons is quite out of the power of the generality of practitioners.

The author had been in the habit of using Roth's scoliosimeter and his own diagrammatic pad until within the last two years. On the suggestion of Mr. Barwell he was led to discard them for the use of photography. Although photography is not an ideally perfect method, yet its advantages considerably outweigh its disadvantages. To take the latter first, it does not show as clearly as one could wish the horizontal deformity, a large prominence backwards often not appearing as marked as it really is. Patients often, too, object to be taken. Its advantages, however, are many. Thus it is a scientifically accurate record, and it is quickly done. By this method not only is the surgeon able (with his trained eye) to detect improvement or the reverse, but the patient herself and her friends can be provided with a picture of the case before treatment begins.

This is an advantage when the cure is prolonged, for the memory often fails to recall how bad the case was at the first. It is advisable, if time allows, to take several pictures of the same case; one should be taken of the patient from the hips to the neck, another of the full length back view with the author's vertical-meter in position; and a third of a front view. It is also as well to take a "best possible" position photograph.

For taking these photographs a good quarter-plate camera is necessary. Marking the places for the patient and the camera with drugget pins run through the carpet, the photos can be taken in any well-lighted consulting-room, and a uniform size of picture is obtained. Nearly all the photographs in this book are taken with the patients' back directly opposite the window of the writer's consulting-room. Experience has shown him, however, that better representations are obtained by placing the patient at an angle to the window and using a reflector.

For scientific accuracy however, there is nothing so effective as Mr. Barwell's scoliometer which measures rotation at the same time that it measures the amesiality of the spine up to near the shoulder. This most useful instrument is best described in Mr. Barwell's own words. The author has therefore appended the description (by Mr. Barwell) from his work on "Lateral Curvature of the Spine."

The instrument is of brass, and stands upon three nearly horizontal feet, the two hind ones projecting radially from the centre eleven inches; the front one (*a*) is longer, viz., fourteen inches. From their junction at the centre a one-inch square tube (*b*) rises perpendicularly one and a half feet. In it slides smoothly and accurately a square rod (*c*), which is fixable by a clamp screw. This rod bears atop a horizontal plate (*d*), two inches broad by six long, projecting accurately over the longest of the three supporting feet. At the end of this plate, and at a precise right angle with its long axis, is a rule (*e*), fifteen inches long and scaled into inches and tenths. Sliding on each lateral half of the rule inward and outward, but fixable by a clamp screw, is a gauge six inches long (*f-f*). The horizontal brass plate has, moreover (*n*), along its long axis and beneath the exact centre of the rule, a slot which allows a wire to play in it in such wise that it can be thrust outward half an inch or more.

It will, I think, conduce to the comprehension of this instrument, which is really simple, though it seems complex in description, if I first explain how this first or lower part

lower rule is about two inches from his body surface ; the slide is drawn out until the rule is on a level with the ink-blot on the sacrum ; the little wire is protruded, its end just touched with a freshly-dipped pen, and again withdrawn. Now the instrument is slid further until the edge of the rule comes in actual contact with the posterior part of the pelvis ; the gauge slides are brought inward and into touch with the sides of the ilium, care being taken that one of them is in contact with one of the pencil dots at that place ; the wire is extruded until its contact with the skin makes a little dot where the middle of the sacrum should be if the pelvis were perfectly straight. The distance of the gauge from the pencil dot on the other ilium is measured.¹ This part of the instrument indicates, therefore, the amesiality and the obliquity of the pelvis, and, moreover, measures accurately the degree of what obliquity may be present ; it must be remembered that whenever this latter condition obtains the first and second sacral spines must be out of the centre, for the whole ridge slants, its upper end having moved towards the side on which the pelvis is lowest.

An amesial condition or position of the pelvis and lower part of the figure is certainly present in a large proportion of cases. Its detection by means of the scoliosis gauge is as follows : When the instrument is so placed that the lower rule (*e*) is in contact with the pelvis, the surgeon sees if its centre corresponds with the middle line of the sacrum ; if not, he depresses the garments enough to expose the upper part of the *rima natium* ; then, placing his eye so as to get slide (*c*) in one line with the lower part of slide (*g*), he observes that if that part of the body lies in this line or to one or the other side.

As yet only a comparatively minor part of the investigating power of this instrument has been explained ; the chief portion lies above the horizontal brass plate (*d*) that bears the fixed rule. Now, in this plate, four inches from the edge

¹ This is most expeditiously done with compasses, the distance between its points being tested on the rule.

of the rule, is fixed a socket and a clamp screw. In the socket a third square rod (*g*) plays up and down, being fixable by the screw—the top of the rod bears a horizontal square tube (*h*), which runs in a direction away from that of the longest foot, *i.e.*, away from the plane of the patient's back when the instrument is put in position. In this horizontal tube, and also fixable by a clamp screw, runs back and forth a square rod (*l*), perforated from end to end. At its extremity, nearest the patient, is a horizontal rule (*k*), which rotates glibly and horizontally on a little nut, and from the centre of which runs directly backward an indicator needle, four inches long, that plays over a graduated sextant of equal radius; moreover, the quite smooth perforation in this rod carries a polished steel wire (*m*), one-quarter inch diameter, which quite fits the channel yet runs easily, and which is filed to a blunt point in front.

The mode of obtaining information from this part of the instrument is as follows: The skin over the middle of the second or third lumbar and the fifth, sixth and seventh spinous processes is to be marked with a dot by an aniline skin pencil, and the end of the wire is to be touched with ink.¹ Then, the instrument being brought into position as above described, the upper slide is drawn out until the revolving rule is on a level with the sixth dorsal vertebra. Here it is fixed by a turn of the clamp screw; the surgeon then directs the patient to clasp his hands and hold them with the elbows straight over the centre of the hypogastrium, and pushes forward the horizontal square rod. If the back be straight, *i.e.*, if there be no rotation of vertebræ, the rule, as it comes in contact with the posterior thoracic wall, remains square to the rod and the indicator rests at zero. But if there be rotation, *i.e.*, if one side of the thorax be on a plane posterior to the other, one end of the rule will be pressed backward, and when the rod has been pushed so far forward that the edge of the rule is in contact with the back,

¹ Any desirable vertebra can be selected.



FIG. 13. Case of Caries in an Adult.

on each side of the spine, the indicator will mark on the sextant the amount of rotation in degrees and fractions. The wire is then pushed out, and the spot which it makes on the skin, and which is in the true perpendicular of the figure, will be a certain distance from the pencil dot made over the spinous process of the deviated vertebra; this distance, measured by compass and checked upon the rule, gives the amount of lateral deviation. The surgeon can then score in his note book—rotation x degrees; lateral deviations y decimals of an inch: these notes can be used for future reference in regard to improvement and effect of treatment.

If it be further desired to ascertain the relative level of the scapulæ, the patient is told to let the arms hang down by the sides—the angles of those bones may be touched with the blue pencil—the upper slide is drawn to a level of the lower mark, the rule pushed forward, and the distance between this and the higher mark measured with the compass.

It is scarcely necessary to add that, although I have for simplicity's sake mentioned only three dorsal vertebræ as the places for measurement, yet the instrument should be used for other parts. More especially is it valuable for gauging rotation at the loins, in which segment of the column that malposition is very difficult to estimate by mere eyesight. In the dorsal region we can look down along the plane of the back (see Fig. 22) as far as the ninth vertebra, and thus form an estimate more or less inaccurate of the rotation; but in the lumbar region we cannot thus see the parts in, as it were, a bird's-eye view.

The instrument is then valuable in several different ways: Firstly, it indicates accurately faulty positions of the pelvis. Secondly, it gives an exact mathematical measurement both of rotation and of lateral deviation. Thirdly, it gives these measurements in a manner which enables the surgeon to write down in figures a record of the progress of the case from visit to visit. Fourthly, in cases of very slight or of doubtful curvature it is a valuable diagnostic method.

Having experienced the value of mathematical aid, I

would not now dispense with this instrument, which raises the appreciation and knowledge of every deflection of the spine almost to an exact science, and enables us to estimate, if it be desirable, the amount of deviation of every separate vertebra.

It would appear that this very useful instrument has not been as much used as its great accuracy would entitle it. In trying to obtain one, the author found great difficulty. None of the instrument makers had one in stock. Several offered to make one at prices ranging from £21 upwards. Finally by the help of an intelligent ironmonger and carpenter, one was made of well seasoned wood, faced with brass, for about a fourth of the above price, and is the one figured above.

A well marked case then presents no difficulties in diagnosis with its tilted pelvis, altered shoulders, curved spine, unequal subaxillary spaces, and its amesiality. A slight case is often more difficult to detect, because owing to the bodies of the vertebræ moving more than the spines, considerable rotation may have taken place, showing very



FIG. 14. Case of Caries in a Child.

little, if any, alterations of the spines. It is in these slight cases that Mr. Barwell's scoliometer becomes so useful, as by its means a very slight degree of rotation may be detected.

A guess at amesiality may be hazarded from an examination of the patient's boots. Even when there is not flat foot, or when the condition appears equal on the two sides, it will mostly be found that one side of one boot is more worn than the other. If both boots are worn unequally, the inequality will not be the same on both sides. Thus the inner side of one and the outer side of the other will be generally the condition. If the amesiality be to the left, the outer side of the left and the inner side of the right will be the part most worn. This is contrary to what one would expect, because in the above case it is most frequently found that the left is the flatter foot.

Much difficulty, as was before mentioned, is frequently found in measuring the legs. In the horizontal position

this is easy enough, but it is the difference in the vertical and not in the horizontal position that is required. This may be measured by a tape, from the anterior superior spine to the floor when the patient is standing up or leaning against the wall; or a large pair of compasses may be used. The most satisfactory measurement is obtained by Mr. Barwell's scoliometer.

From caries, or Pott's disease of the spine, lateral or rotatory curves are most easily distinguished when once the essential points are grasped. The alternative name for caries, viz., angular curvature, carries one a long way on the road. An angular curvature is almost necessarily caries or its results. A prominent tender vertebra points, though not infallibly, to caries. But perhaps the most diagnostic point of all is spasm. With caries there is nearly always spasm of some of the muscles attached to the spine which causes some limitation, it may be a great deal, of movement. The limitation will be

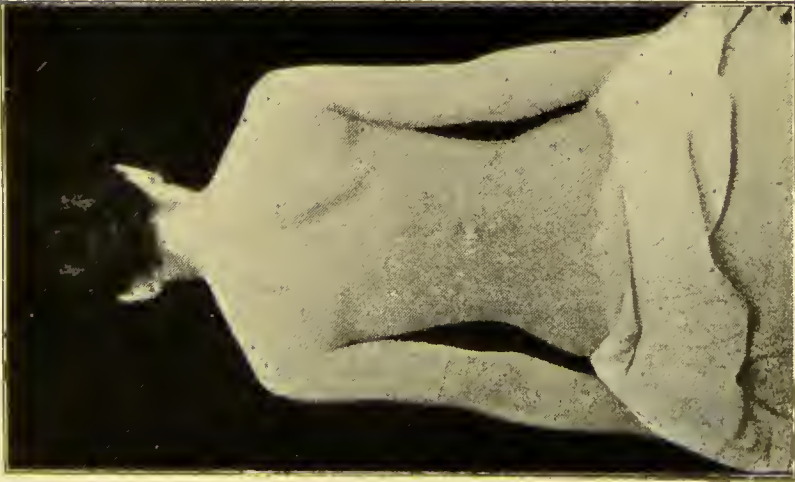


FIG. 15. Case of Lateral Curvature with Irregular Vertebrae.



FIG. 16. Same Case after Six Weeks of Muscular Exercises.

obvious if the feet or pelvis are fixed and the body bent in various directions by the surgeon. Sometimes it will be seen that the movement between several adjacent vertebræ is altogether abolished. This is due partly to inflammatory thickening of the parts covering the spine, and partly to spasm of the muscles. Other evidences of tubercular disease would of course aid the diagnosis. The practice commonly recommended of running a hot sponge or piece of ice over the spine for evidence of a tender spot is apt to be fallacious. For after all one only diagnoses periostitis by this means, and rheumatic periostitis is not uncommon in cases of lateral curvature. Hence comes the pain exacerbating or occurring only at night. It happens, however, that early caries not infrequently exists with well marked lateral or scoliotic deviations. These cases often present the greatest difficulty in diagnosis. The author unfortunately has on his mind the memory of a case in which the presence of caries

was unfortunately overlooked, but was only noticed after two or three weeks of gymnastic exercises had been performed. The diagnosis, owing to the rapid progress of the disease, was soon placed beyond a doubt. The case ultimately recovered completely, but rest in bed for several weeks was necessary to counteract the effect of this mistake.

The diagnosis is therefore most important, for, as can be readily understood, the treatment of these conditions differs widely. If a doubtful case, it would be better to take the graver view provisionally, until the diagnosis was settled beyond the possibility of doubt, or perhaps a consultation would settle the matter.

The cases which do frequently get mistaken for caries are those of curvature of the spine secondary to other conditions, such as disease of the hip, knee, or ankle, in which there is shortening or in which the patient habitually uses the sound leg for standing, or for carrying most of the weight. These

cases are, however, very frequently diagnosed as caries and treated with jackets or instruments. Two or three such cases have been seen by the writer wearing heavy poroplastic jackets, having been sent thus clothed to St. Andrew's Convalescent Home from various hospitals.

Mr. Tubby, in his treatise on orthopædic surgery has pointed out the occasional occurrence of prominent vertebræ in scoliosis, and the writer has met with such cases. They are mostly noticed in those cases where kyphosis predominates over the scoliosis. Fig. 14 represents such an one. The lumbar spine is markedly kyphotic, and the scoliosis only shows about 3° on the scoliometer. There is another feature in this case, viz., that the last few dorsal vertebræ were not only prominent and painful but joined the lumbar at an angle. Yet the case was not one of caries. She had been condemned to the recumbent posture for a year by a medical man of some eminence. Six

weeks of medical exercises at the gymnasium entirely removed her pain and improved her general health to such an extent that she described herself as "fit for anything."

The deformity in these cases is probably due to some habitual position, causing an extra degree of absorption of the intervertebral discs below the prominent vertebræ, and very unequal stretching of the ligaments in that situation.

CHAPTER III.

ON VARIOUS MODES OF MECHANICAL
TREATMENT.

Treatment in the 17th Century, and in 1841—
Instrument Makers Treatment—Inefficient
Spinal Supports — Barwell's Opinions —
Poroplastic and Plaster of Paris Jackets—
Ordinary General Practitioner's Treatment
—Useless Treatments—Brodhurst's Views
—Noble Smith's Views—" Keeping the
Key "—The Essential Conditions which an
Instrument should Fulfil — The Proper
Stage for the Use of Instrumental Support
—Barwell's Sloping Seat and Rotation
Bandages — Suspension — Rachilysis—Au-
thor's Vertical Bolster, and Spinal Chair.

IN a work by Ambrose Parey, pub-
lished in 1678, one finds set forth the
medical opinion of that day on the
causes and treatment of spinal curvature,
and it may be interesting to give here
an extract therefrom :—" Of Amending

the Deformity of such as are Crook-Backt.”—“ The bodies of many, especially young maids or girls, by reason that they are more moist and tender than the bodies of boys, are made crooked in process of time, especially by the wrenching aside and crookedness of the backbone. It hath many causes, that is to say, in the first conformation in the womb, and afterwards by misfortune, as a fall, bruise, or any such like accident, but especially by the unhand-some and undecent situation of their bodies when they are young and tender, either in carrying, sitting, or standing, and especially when they are taught to go too soon, saluting, sewing, writing, or in doing any such like thing. In the meanwhile, that I may not omit the occasion of crookedness, that happens seldom to the country people, but is much incident to the inhabitants of great towns and cities, which is by reason of the straightness and narrowness of the garments that are worn by them, which is occasioned by the folly

of mothers, who while they covet to have their young daughters' bodies so small in the middle as may be possible, pluck and draw their bones awry, and make them crooked, for the ligaments of the backbone being very tender, soft, and moist at that age, cannot stay it straight and strongly, but being pliant, easily permits the spondels to slip awry inwards, outwards, or sidewise, as they are thrust or forced. The remedy for this deformity is to have breast-plates of iron, full of holes all over them, whereby they may be lighter to wear; and they must be so lined with bombaste that they may hurt no place of the body. Every three months new plates must be made for those that are not yet arrived at their full growth, for otherwise, by the daily afflux of more matter they would become worse, but these plates will do them small good that are already at their full growth."

More than 150 years later, however, we find that a considerable advance has been made both in knowledge and in the

treatment of cases of spinal deviations. Thus the following extract from Tuson's book on curvature of the spine, published in 1841, will show that it might with equal truth and reason have been written at the present day.

“Various plans have been recommended to remedy curvature of the spine, and the author of each has pertinaciously adhered to his own, treating all cases indiscriminately, and not looking, as should be done, to the cause of the curvature, and whether it be in a lateral or any other direction. Extension, rest, counter irritation, instruments, pressure, exercise, etc., have each been recommended and used by their own advocates; but in the nineteenth century, when science has so greatly improved, and is daily making such rapid progress, fallacious reasonings must give way to practical experience; and I trust that I shall be enabled to make manifest the absurdity and unscientific mode of treatment too often applied to the subject under consideration, and that no de-

pendence can safely be placed on the principles and practice to which I have referred.

“But while I thus expose the ignorance of the empiric, let it not be supposed I condemn the works of those scientific men who have devoted their attention to the subject, and to whom the profession and the public are much indebted for useful and scientific observations on the affections and diseases of the spine.”

It is a well-known fact that patients often go direct to an instrument maker without first consulting a medical man, or, on the other hand, are given over to an instrument maker by a doctor who perhaps has no special knowledge of this particular species of complaint. The instrument maker, who is a mechanic for the most part, profoundly ignorant of the normal anatomy and physiology of the spine, designs his instrument to overcome the, to him, more obvious appearances of the deformity, when the instrument is on. And like the skilful dress-maker or tailor, he is frequently very

successful in hiding the deformity. Only recently a case (see fig. 17) has been under the writer's care which had been in the hands of such an instrument maker for the space of one year. The deformity had been first noticed three years before, and for two years her mother had at intervals tried to prevail on her medical man at the place where she resided, to undertake the treatment, but was always assured that the child "would grow out of it." At last, in despair, she took her daughter to see a physician in London, under whose care she herself was at the time because of some uterine trouble. Strangely enough this gentleman referred her to an instrument maker, to whom she accordingly went. Now, during the year that she was under this mechanic, she had to make frequent visits to London in order to have the support which he had applied altered. When first seen after a year of this mechanic's treatment, there was such weakness and atrophy of the back muscles, that the patient could not stand for



FIG. 17. Case of Curvature after Treatment by an Instrument-maker, showing Absence of Muscular Development.

five minutes without the support of the instrument. The deformity was as shewn in the picture. To remedy this unfortunate condition, it took six weeks of massage and Swedish movements before she could remain all day without the support to which she had become accustomed. Under this latter treatment the deformity and the general health so much improved that the mother, being satisfied with the results obtained, became unwilling to spend more time and trouble on the treatment. The patient now walks about without there being any apparent deformity. Thus it is conclusively shown that the instrument only encouraged laziness in the weak muscles, and that the patient simply sank into her support, being able to remain sufficiently erect for all ordinary purposes without any muscular exertion. The falling in the support only increased the curvature and had no compensating good effects whatever. It was merely owing to the fact that the patient could not sleep in the support, that the deformity had not already become permanent.

The very rapid improvement under measures simply calculated to promote general muscular tone without any specially corrective exercises is, too, instructive, because it shows how much might have been accomplished three years before, and how absolutely unnecessary was the use of any support at all. In fact, the only effect of this instrument was to make the case worse.

Mr. Barwell has very well pointed out the uselessness of most so-called spinal supports. He points out the impossibility of getting support when one cannot get even one fixed point. Though one can hardly agree with him about the impossibility of fixing a pelvic band firmly, yet all must agree with his dictum on the uselessness of crutches which rise up from the pelvic band as a basis of support. He rightly points out that as the shoulders having a considerable up and down range of movement, the only effect of a crutch in the axilla is to push up the shoulders without having any action at all on the spine. In order

to straighten the spine by such means, the shoulders would have to be pushed up to their utmost limit, involving a pressure which the delicate structures in the axilla would not tolerate for more than a few minutes. If, on the other hand, such pressure be absent, the patient must sink into the instrument as did the patient whose case has been related above.

Further, he shows that the crutches are often moulded to the already deformed and unequal sides, and thus, the possibility of cure by other methods is at the same time *prevented* while the instrument is being worn. Figs. 18 and 19 are photographs of another patient who came to the writer with a history of getting steadily worse while wearing such an instrument. In figs. 20 and 21 are represented the same patient after three months of a more rational treatment, a result as good, the author ventures to think, as could reasonably be expected from so bad a case. So great too was the improvement in her

general health, that three months after commencing treatment she was able to take a position as a clerk in a post office. Previously she had been unable to do anything, and was only a burden to her friends. This case, which has many important bearings, will be referred to again in a later chapter.

After pointing out the uselessness of the poroplastic jacket as a support from its being very soon made pliable by the warmth of the body, unless made rigid by steel bands and hoops, Mr. Barwell sums up as follows, "it ought not to be used for growing patients with that necessity for free bodily exercise which youth implies ; for elderly people with the second recrudescence of curvature, it is generally unbearable."

The plaster of Paris jacket has so often had its drawbacks pointed out by nearly every writer on spine complaints, that it is unnecessary to do so again here.

The treatment as ordinarily carried out by the general practitioner may be described as simple and useless. Cases



FIG. 18. Bad Case of Scoliosis before Treatment.



FIG. 19. Back View.

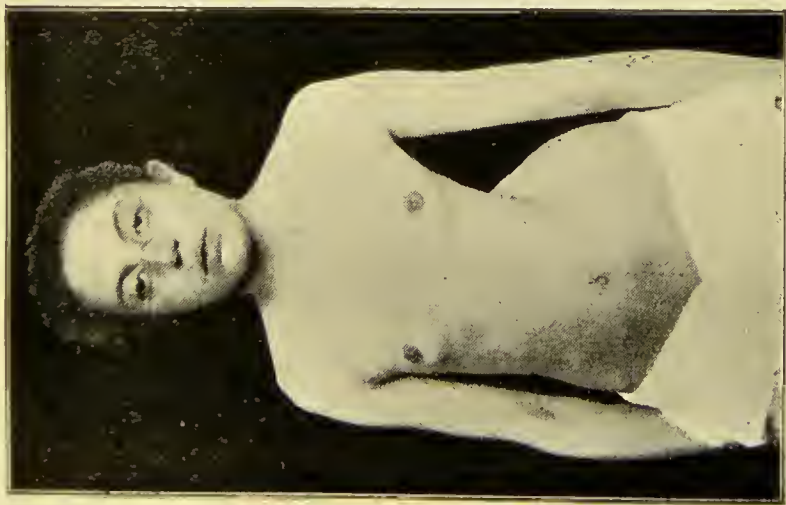


FIG. 20. After 3 Months of Treatment.

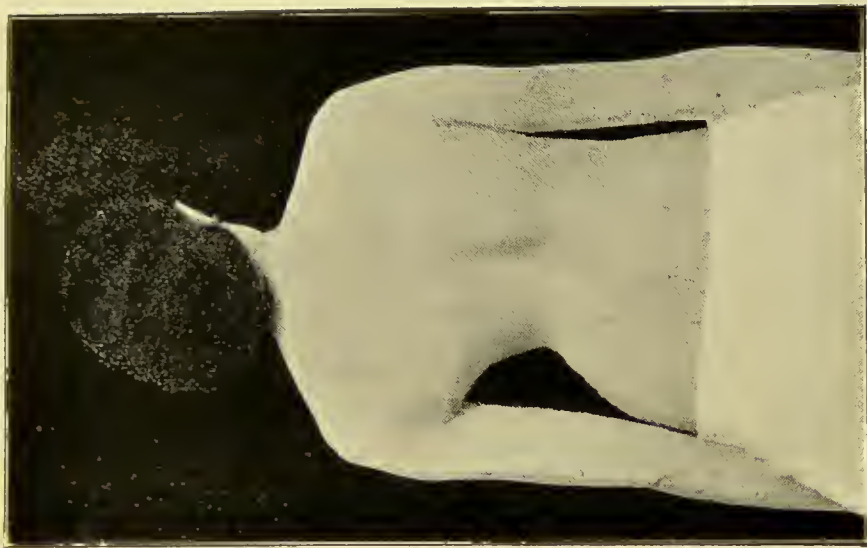


FIG. 21. Back View of Same.

however, are frequently described as "curvature of the spine," which are simply cases of flexible spine from weak muscles without any permanent lateral or rotatory deformity. Such cases might easily become marked examples of scoliosis. Here almost any simple treatment designed to strengthen the general tone and vigour gets the credit of having cured a curvature. It is quite a common thing to meet with bad cases in which the treatment prescribed by the medical attendant has been a tonic, and a trapeze or dumb-bells, without any directions as to how the latter are to be used. Sometimes the patient is directed to hang from a trapeze for five minutes daily, or often a patient is told to have "a dozen lessons in the gymnasium" without any directions whatever being given to the gymnastic master as to what sort of lesson to carry out.

Again, it is not an uncommon thing for a patient to be given over to a masseuse, or other three-months-trained professor of Swedish movements, for cure, without directions or supervision.

It is certainly curious that practitioners, who would not dream of handing over eye or ear, or nervous cases to such non-surgical persons, should do so with a light heart when the spine is the organ affected. To send a patient to a gymnasium for a "dozen lessons" or other such vague directions, is like sending a patient with dyspepsia to a chemist's shop with orders to help himself.

Referring again to the question of instruments we turn to the works of two other spine specialists. Here we find Mr. Brodhurst, in his interesting work on "Curvatures and Diseases of the Spine," advocating the use of spinal supports for all cases in which the deformity does not disappear in recumbency. He gives no picture of the kind of support he advocates, but lays down the following principles, "a spinal support must be perfectly fitting in all its parts ; it must be light and so tempered that it shall not bend with the weight of the body, and yet that it may be bent, when mechanical force is applied, without breaking. The band

about the pelvis should fit exactly, and therefore it should be fashioned to the pelvis itself ; and the lateral plates, which are carried on levers and moved by compound movement, lateral and antero-posterior, should correspond exactly to the surfaces to be acted on. Therefore it is necessary that a cast of the back be taken, so that the spinal support may be accurately fitted. The lateral plates should be so placed that they may apply, if possible, to the lower portion of each curve, and they will be broad in proportion to the curve to be acted on. The dorsal curves will be acted on through the ribs. The plates therefore should be moulded to the shapes which these have assumed, and they will from time to time need to be remodelled. The force will be applied in the reverse direction to that in which the deviation has occurred, and the pressure should, as much as possible, be made to follow the course of deviation of the parts themselves ; and consequently it should never be directly lateral."

“It is necessary that the plates of the support shall be accurately in contact with the curves at all times when the patient is not recumbent, and that as the curves alter, the plates shall be changed, both in shape and in position. When the combined forces of a well adapted instrument are made to act in the directions now indicated, namely, obliquely, towards the centre, they tend to unbend the curves. The movement which is thus commenced in the primary curve is often greatly assisted by muscular action, and in this manner the several curves are at the same time, or in succession, acted on and unfolded.

“The action of the spinal support should be that of uplifting, and therefore pressure will not be made on the greatest convexity of the curve, but on the lowest arm of the curve, and on the extremities of the arc. By making pressure upwards and forwards, rotation may be overcome and the curves themselves opened. This action induces extension of the spine, and there will

be found an immediate increase in height to the extent of three fourths of an inch to an inch, and even more. Pressure should commence at the seat of the primary curve, and there it should always be greatest." Now there is no doubt but that in Mr. Brodhurst's own hands, treatment with instruments devised on these principles has been attended with great success. The spine is effectually splinted in such a manner that any muscular movement tends to undo the curves, while the instrument prevents any increase of the abnormality. The objection however to his treatment, as here proposed, is the necessity of taking a plaster cast of the back. The author, however, quite failed, owing to the absence of a descriptive plate to even diagrammatically construct an instrument which would fulfil all the conditions given in the above account. Whether others have been more successful, he has no knowledge. It is for this reason that he is unable to quote practical results from his own experi-

ence. If the devising of such an instrument for each case were absolutely necessary, spinal curvature cases would be for ever removed from the possibility of being treated at home by the general practitioner.

The writer confesses to being a comparatively recent convert to the use of spinal supports in certain cases, though at first as firm an opponent of them as those specialists who apply only one of the resources of our art to the treatment of every degree of the disease. Without prejudice to the views on the treatment of lateral and scoliotic curvatures expressed later on, it may here be stated that to be sufficient the instrument should be in reality a portable spinal chair, that is to say, it should be possible for the patient to be able to relax her muscles and yet to be maintained in a good position. Further it should definitely act to a large extent as a splint in the same way as that described for the treatment of wasted limbs from infantile paralysis, *i.e.*, it

should tend to stretch contracted muscles and ligaments, and slacken lengthened ones. Although Mr. Noble Smith does not seem to have claimed to fulfil this latter condition, yet the writer thinks that the very excellent instruments which he uses, really do so.

In a bad case, the first condition is to get the spine straight by restoring the ligaments and muscles as far as possible to equal lengths on either side of the spine by the use of efficient instruments. The muscles must follow the ligaments in this restoration. By properly prescribed exercises the muscles may be made to precede and help this restoration. Then, when the spine is straight, the muscles may be equally exercised. A description of Mr. Noble Smith's instruments is given later on, more or less in his own language. Though he claims mobility for the lumbar spine in an antero-posterior manner, as indeed there is, the dorsal or worst part of the curve can with properly adjusted plates

only have mobility into a better position. As soon as the spine has power to move into a better position, then is the time to re-adjust the plates.

And this brings us to the question of "keeping the key," which phrase is undoubtedly a remnant of the old apparatus fitted with rack and pinion. Personally the author owns to commencing his studies of lateral curvature with a deep-rooted and firm conviction of the iniquity of doing so. An entire and complete change of opinion has however been the result of those studies. After thirteen years of practice, both hospital and private, in which he has lost few opportunities of making the most of such cases of spinal curvature as have come before him, he still finds that every new case requires considerable thought and investigation, not only before the best plan of treatment can be prescribed, but also at frequent intervals during the treatment. The cases vary so much in the rate of change, and also in the amount of

change from time to time, that it is almost impossible for one who has not seen the case from its very beginning, to be successful in carrying on a treatment which he has not only not prescribed, but which in all probability he does not understand.

It is an extraordinary thing that men who shrink from undertaking any eye case whatever, enter on the treatment of a case of curvature with a light heart. Several severe cases which required prolonged instrumental treatment, have assured the author that a cure had been promised them from a tonic and a course of two "lessons" a week at a gymnasium. The gymnastic master was left to evolve the "lessons" from his own inner consciousness. When such lamentable absence of knowledge of spinal matters is so general, can those specialists, who have spent years in acquiring that knowledge, be justly blamed, if taking an interest and a pride in their work, they refuse to depute to others who are without the

necessary knowledge the carrying out of their treatment?

The so-called "key" is nothing but a simple form of wrench for undoing the buttons which serve to fix the plates. The patient's doctor would find no difficulty in getting one made at any blacksmith's if he wished to supersede the specialist. This being so, where is the objection to keeping the key, a thing which is supposed to involve retention of the patient. If the patients stay it is not because of the holding of the key by the specialist, but for the best of all reasons, viz., on account of the benefit they receive from him. Specialists can therefore well afford to treat with contempt those periodic allusions to the "keeping of the key," which so often appear in the medical press, and indeed from the pens of those high enough in the profession to know better.

In the first stage of curvatures, when only the muscles are at fault, when the patient can by an effort hold herself

straight, if only for a second, there can be no doubt but that the use of instruments is utterly wrong.

In the second stage when the discs, ligaments, and muscles are all affected, instruments, though not absolutely necessary, may be and are used by some surgeons.

As it has been shown earlier in this work that stooping is decidedly an active cause of scoliosis, it will therefore be seen that these instruments, which at once remove the stooping, have removed at least one very active cause of mischief. They at once put the erectors into a more favourable position for returning to equal lengths. The use of instruments alone can often get a spine straight, but the muscles must be made at the same time strong enough to keep it straight, when it has been made so.

It is not enough merely to put on an instrument, it is necessary to watch carefully the progress of the case, just as in fact one would watch a case of talipes

when treated with a splint or instrument. By carefully watching and moving the plates so as to take advantage of each little improvement as it occurs, a very rapid progress may often be made. On first applying the instrument a very great improvement is at once noticed, as, indeed, will be seen from looking at figs. 19 and 22 which have been reproduced from photographs which were taken within a week of each other. The instrument shown in the diagram was carefully adjusted according as it became necessary. In addition the patient discarding the instrument performed daily exercises in the Folkestone Medical Gymnasium. At the end of three months the marked improvement which is shown in figs. 20 and 21 had taken place.

In the third stage, when the bones have become much altered in shape, improvement is still comparatively easy, but cure, though theoretically possible, would require very prolonged treatment. The younger the patient, especially if

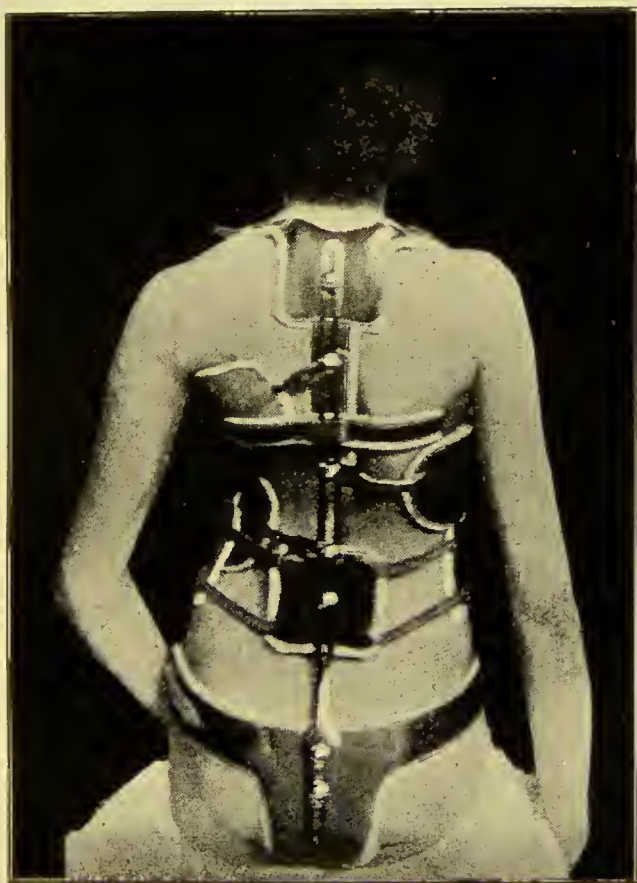


FIG. 22. When the Support was first Applied.
(See Fig. 19).

below the age at which growth ceases, the more possible the chance of cure, but the treatment would have to be general and instrumental.

As regards the fourth stage, when the bones have become fused together instruments are only required if pain is present or if the deformity is still progressing ; but in this case the muscular exercises will be all the more necessary in order to maintain the general health.

The instruments used by Mr. Noble Smith are the only ones that are known to the writer of which it can be said that they are constructed on sound principles. They have one great advantage in that there is no mystery about them. The accounts given by Mr. Noble Smith are so clear and so well illustrated that any practitioner who chooses to make a study of these instruments can get them made at almost any ironmonger's shop and covered by any saddler. The author was fortunate enough to have the assistance of Mr. Noble Smith, himself, when he first applied the instrument

to the patient who is depicted in fig. 22. The illustrations give a very accurate idea of the instrument. The instruments, which are modified from an invention of Mr. E. J. Chance, prevent the spine falling into a bad position, and also tend to force it towards a normal one without interfering with the action of the muscles, or the development of the chest. The instruments are not mere "maker's machines," that the maker closely fits on and alters, but are rather in character like a splint, and afford in a similar manner the means by which the surgeon can bring pressure or support to bear on any part of the trunk where such pressure or support is desirable.

Its primary object is to keep the spine in as upright a position as possible in an antero-posterior direction, for it is a well known fact that as flexion increases the deformity and especially increases the rotation of the vertebræ, so extension lessens the deformity. The means by which this purpose can be effected is

by the use of shoulder straps which act from before backwards and not from below upwards. In the case of weak backs the tendency is for the spine to bulge back in the lower dorsal and lumbar regions, and, therefore, it is certainly most desirable to control such projection. As the instruments do not curve into the hollow at the back and act as permanent supports, they do not therefore relieve the muscles of the back from action and so conduce to their degeneration and weakness.

A small pad is therefore placed in the support opposite the lumbar region so as to restrain the back from curving posteriorly. Thus, by preventing this bowing backwards the lateral curve is removed or prevented. Now the pad is so arranged that it does not act when the patient is holding herself erect, at a time when, in fact, it is not wanted, and accordingly the dorsal muscles are allowed to act. But directly the spine is allowed to subside, then the pad comes in contact with the back and

prevents it from bulging any further. As improvement takes place, the pad is brought nearer to the spine but as it is never brought so far forward as to retain the spine in any one position, so room is always left for muscular action. If lateral plates have to be used they act in the same way as the back pad, viz., they prevent the deformity from increasing.

Mr. Noble Smith adds at the end of the above description (which is, though somewhat condensed, more or less in his own words), "that mechanical aptitude and considerable mechanical knowledge are absolutely necessary to the surgeon who would straighten a curved spine. It is unreasonable to expect success if we delegate to instrument makers the devising, the adaptation, and the adjustment of instruments with which we aim at solving a very difficult problem. The knowledge of the physiology of the movements of the parts affected, of the anatomy and the nature of the pathological changes which may

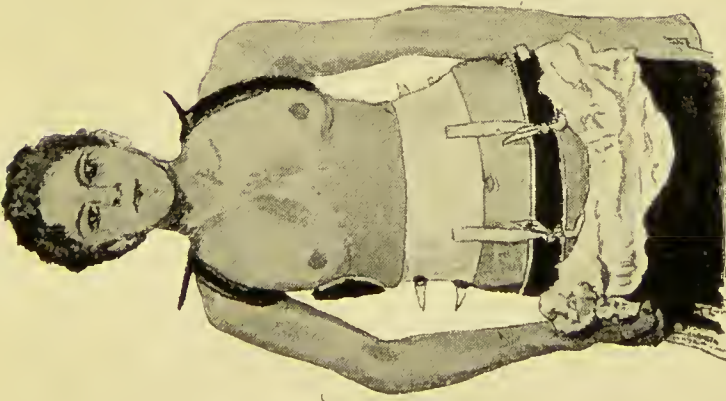


FIG. 23. Instrument for Double Curvature,
front and back view (Fig. 24).

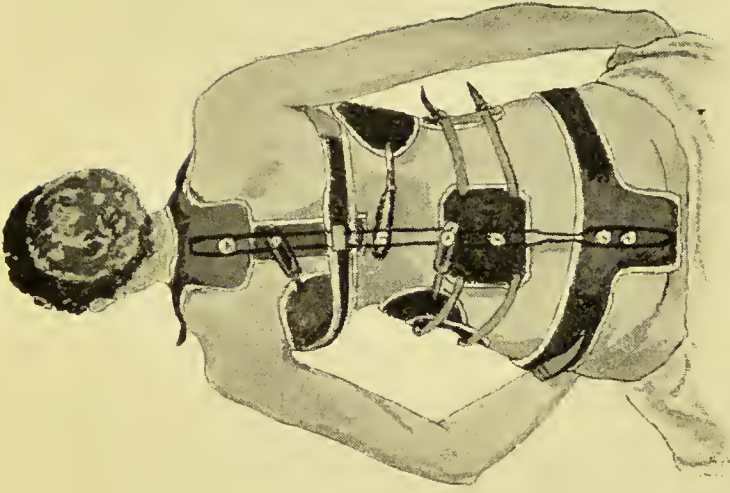


FIG. 24.

take place, is required before the operator can form a judgment as how best to apply and adjust his mechanical measures."

His instruments then do not abolish muscular action, but afford support in a good position directly the muscles become fatigued. They allow and encourage free "thoracic respiration." The patient also has the advantages which would be obtained from resting in the most perfectly constructed chair, without the risk of ever allowing the spine to "subside" from want of support.

In passing, the reader is asked to note that the writer does not wish to imply that the authorities quoted advocate the treatment of spinal deviations by instruments alone. Both of them make a special point of the value of out-door games, and other forms of muscular exercise.

There are certain apparatus used by Mr. Barwell which especially deserve notice. In the case of children, for

instance, he uses the sloping seat, which is simply a wedge fixed to the seat of the child's chair. By so arranging it as to raise the pelvis on the side of the convexity of the lumbar curve, a curve of the spine in an opposite direction to the one present is encouraged. This is meant to act as a corrective. This device, which Mr. Barwell has made use of for twenty years, is, he thinks, sufficient treatment for early cases in very young children. But it will, however, be noted that the wedge can hardly act on rotatory deviations. Curves characterised by no rotation are curable by other means, which are founded on remedying the cause of the defect. The defect is caused by weak muscles, not by sitting on slanting seats.

Again, Mr. Barwell has recommended the use of what he calls lumbar, dorso-lumbar, and rotation bandages. These bandages are composed of pieces of webbing which are interrupted by elastic rings. There is no doubt but that they are very useful as reminders to the

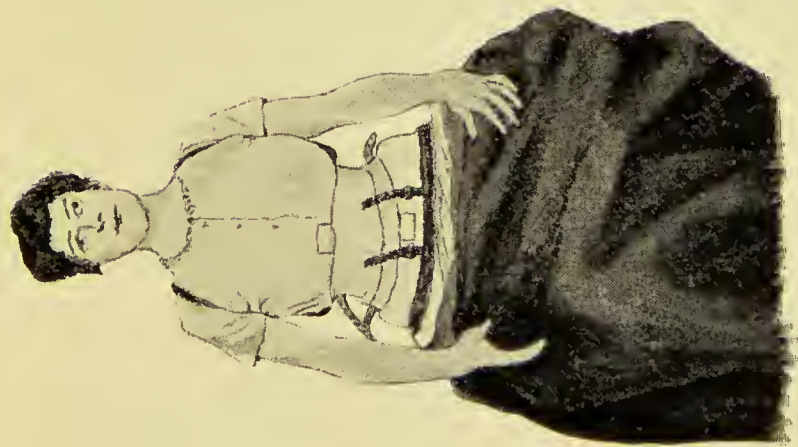


FIG. 25. Instrument for Caries, front and back view (Fig 26).

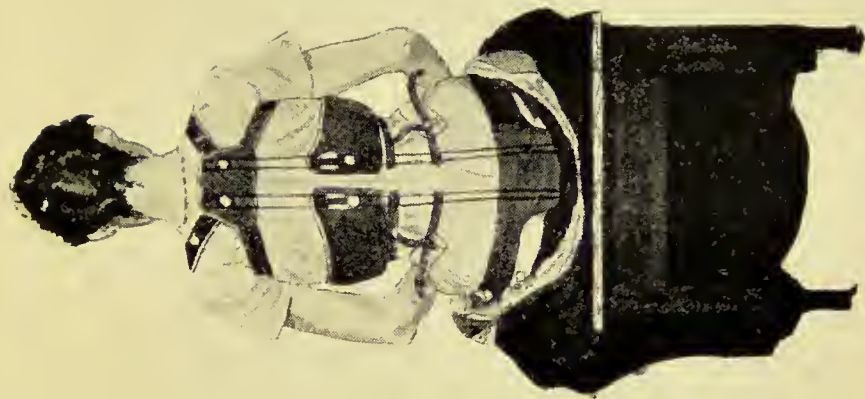


FIG. 26.

patient against the assumption of bad positions, and especially so with very young patients, but with older ones they are not sufficiently powerful to counteract or correct the forces that tend to cause the deformity. Such force, for instance, as is produced by the shoulder falling forwards (stooping), will not be counteracted by such a feebly resisting power as that of a rubber ring.

One must not leave this subject of instruments without first making mention of the various braces and straps that are used for the cure of stooping. It will be seen that from what has been said with regard to the frequent association of stooping with spinal deviation, one can readily understand that cases of curvature are frequently mistaken by the friends of the patient for cases of stooping only. The mere keeping of the shoulders back alone, will not cure curvature, the only effect being that the curve will become altered. The curve becomes less dorsal, and more lumbar, for the cause of the curve, viz., weak

muscles, has not been remedied thereby. The supports solely conduce to atrophy of the muscles, by relieving certain of them of the little work that they were doing. Neither do they conduce to improved thoracic respiration, for the chest is still cramped in a forward position, though the bend is in the upper lumbar, rather than in the dorsal region. An apparatus which acts on stooping so as simply to serve as a reminder without actually giving any support itself (as the oft-told story of Shaw's of the actor and the coat of kerseymere), is free from this objection.

In addition to the wearing of instruments and supports, there are various other mechanical ways of acting on the ligaments, as for instance, suspension. Now, suspension has undoubtedly a beneficial effect, which is increased if the arm of the side of the dorsal concavity grasp a point higher than the opposite one, and it will be observed later that this fact is taken advantage of in several of the exercises which are detailed in the



FIG. 27. Rachilysis.

next chapter. But a caution here is necessary, for suspension is, however, not a method to be used lightly, and in the system advocated it is not used until the muscles have been fortified by some weeks of strengthening exercises. They are then able to some extent to protect the ligaments from excessive strain. Mr. Barwell has introduced a method of forcibly stretching the spinal ligaments by means of pulleys ; an operation to which he has given the name of "rachilysis." It has one advantage over suspension in that the strain is not applied to the whole spine, but only to those parts of it which the surgeon specially wishes to stretch. The apparatus is simple. It consists merely of a system of pulleys, by means of which the force employed can be controlled to a nicety, a pair of cleets, and a pair of rings with screws. These can be fixed to the walls of the surgeon's consulting room. Fig. 27 gives a general idea of a patient being stretched. This method is very useful in advanced cases, much

time being gained by its use. The improvement after twenty minutes' stretching can be shown by the scoliometer to frequently amount to several degrees. This operation must of course be done by the surgeon himself, and not entrusted to assistants.

Another method frequently advocated is to act on the ligaments by a passive unrolling of the spine.

This process is accomplished in the following manner :—

The patient lies on the floor, either upon his back or face, and the surgeon then makes forcible pressure on the more abnormal prominence of the ribs. This method, however, is far from satisfactory, the writer himself having tried it in three cases at the Folkestone Hospital without being able to assure himself that any appreciable improvement was obtained by this means.

But a far more effectual method of passive unrolling of the spine than the foregoing is accomplished by means of the author's spinal cushion. This cushion

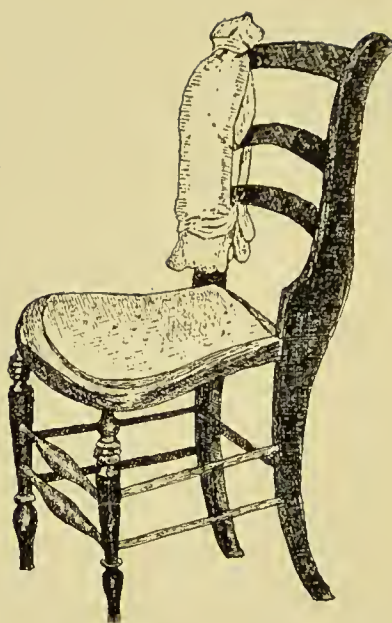


FIG. 28. Author's Spinal Bolster.

consists of a kind of vertical bolster which is fixed to the back of the chair on the side of the raised shoulder. The raised shoulder is generally the one which is further back than it should be, on account of the twisting of the spine. When the patient leans back against the bolster, she forces the shoulder of that side forwards, and in order to get the lower shoulder against the back of the chair, a certain amount of involuntary active force is necessary. And further, the stretching which the stronger muscles of the higher side undergo by this means soon tires them, and so allows of lengthening. The slackening of the muscles on the side of the lower shoulder which this untwisting causes, allows of their shortening. Thus it will be seen that the vertical bolster is a potent means of treatment. This device when placed transversely or obliquely may in the same way be used for stooping, or for the various combinations of stooping and twisting.

A more complicated apparatus than

the cushion is the author's spinal chair, which consists of a straight-backed chair, the back of which moves on a pivot, in such a way that either margin may be

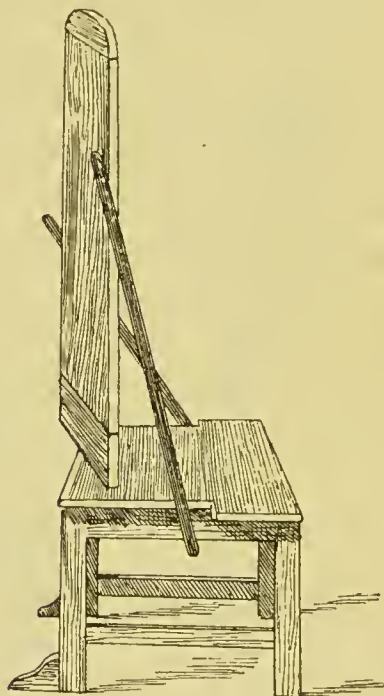


FIG. 29.—Author's Spinal Chair, set for Rotation back of Right Shoulder.

made to advance while the other recedes. The back thereof can be fixed in any position by means of a simple piece of mechanism, and is virtually in effect, a

more developed idea of the vertical bolster. Another advantage is that by

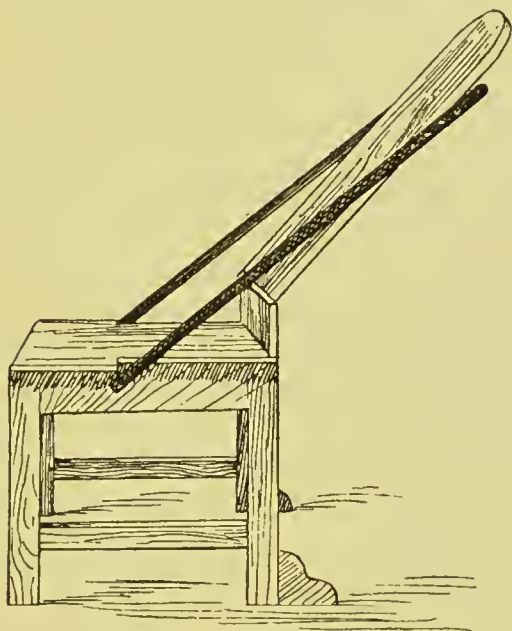


FIG. 30.—Same, used as a Reclining Chair. The Foot piece has been omitted.

means of a pair of hinges, the back may be let down to any desired angle and used as a reclining board.

CHAPTER IV.

ON TREATMENT BY MUSCULAR EXERCISES.

Plato's Principles of Physical Development—
 Early Cases—The Treatment of Unskilled
 Persons—Effect of Physical Development
 on General Nutrition — Recumbency —
 Exercising Planes — Roth's Treatment —
 General Survey—Roth's Exercises—What
 is the Keynote?—The General Principles
 of Treatment by Muscular Exercises—
 Dowd's Machine—Lordosis and Kyphosis.

ANY treatment of spinal deviations caused by weak and feeble muscles, to be successful must embrace some measures calculated to render the muscular system strong and well developed. Such method is not new. The Greeks early recognised the value and importance of physical culture. Plato, more than any other Greek writer, in his immortal work, "The Republic," sets

forth the necessity and forcibly illustrates the value of this form of education; and in his discussion as to how the good guardian of the State is to be made, emphasises and accentuates the need and indispensability of physical as well as of mental gymnastics. He not only defines and explains the value of each, but he also puts each form of education upon a proper basis, and in its own place so that neither form interferes with the other, but on the contrary each becomes of mutual assistance. Thus the physical training of a man is not assigned a more important place than that of the mental training. In fact, a "happy medium" is struck and is adopted by Plato as a motto in the education of a guardian. Excess of either of the two forms of education, viz., music and gymnastics, is conspicuous by its absence. Plato insists that the need of either form of education will be diminished by the judicious use of both in their proper place. For instance, a man who devotes himself entirely to

gymnastics will become brutalised in his nature ; whereas, on the other hand, the philosophical character which entirely devotes itself to music or mental exercises, will become enervated. How then to avoid these two ills ? For it is evident that too little spirit is easily wasted, while too much is converted into irritability. Plato gives us the answer. By a judicious blending of the two forms of education, viz., music and gymnastics, the brutalising tendency of the one and the enervating tendency of the other are neutralised, and a harmony is produced far exceeding a concord of musical notes.

Two thousand years ago, the Greeks thus looked upon the value of physical exercise, yet in ordinary medical practice one meets with large numbers of muscleless people, owing to the ignoring or neglecting of Plato's principles. It is due to the disregard of this first rule of health preached hundreds of years ago, that one so frequently meets with cases of spinal curvature at the present time.



FIG. 31. Case of Curvature from Weak Muscles.

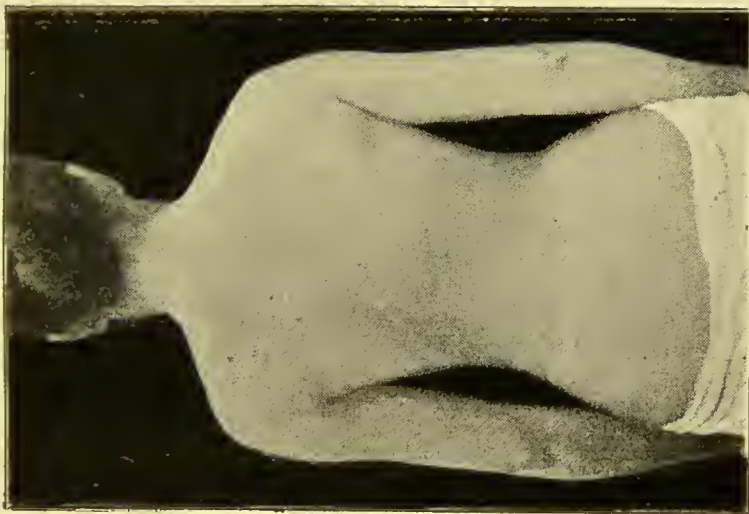


FIG. 32. Same case in the "best possible" position, which became permanent after six weeks of Muscular Exercises.

To show how very little this principle of muscle development is even now understood, the writer of an article in the *Practitioner*, in December, 1895, "On Lateral Curvature of the Spine, from a Physician's Point of View," says, "Special gymnastic exercises may not be without their use, perhaps rather moral than physical; but I have not found them to be an essential part of the treatment." He does, however, give his patients one special exercise, which is the essential part of his treatment. It is to be constantly moving from the crooked to a straight position. What is this, if not a special muscular exercise? But how very monotonous for the poor patient!

It is frequently argued that if spinal curvature is due to weak muscles only, then any measure which tends to make the muscles strong should cure the curvature. In very early cases—especially in those where the deviation constantly varies, that is, where it is now one side, now the other, where, in fact,

the muscles have not, or have not long got into the habit, of allowing the spine to deviate only in one direction—treatment founded on this idea very often succeeds. It is with these cases that the non-medical practitioner, the masseuse, the rubber, the professor of So-and-So's system of movements, the special gymnastic master "*et hoc genus omne*," make their reputations. Where, however, the case is worse than this, their treatments are often failures, or make the patient worse, for their exercises and movements are mostly symmetrically performed, or when asymmetrically, no notice is taken of rotatory changes.

Without medical training, and often even with it, it is impossible to estimate the relative amounts of rotatory and lateral changes in the different regions of the spine. Without this knowledge, the best and quickest treatment can not only not be devised, but any treatment must be haphazard, and liable to be frequently a cause of serious damage.

The first effect of developing the muscles generally is to enable the patient to hold the pelvis horizontal (presuming of course that the pelvic obliquity is due to weakness only), and in the normal position. Thus the chief cause of spinal deviation is removed. Not only is the pelvis held horizontal, but the spine is held straighter, in consequence of stooping of the shoulders and poking of the head at once becoming less. Thus another cause is removed by developing the muscles only.

It can now be readily seen how various very simple methods of developing the muscles get the credit of being able to cure spinal curvature. A cure is, however, more rare than is often supposed, for many of the mechanical conditions are still present though in a less degree, stooping, for instance, and commence acting again as soon as the massage, movements, exercises, or what not, are left off. Any surgeon seeing much of curvature cases, will often be told that "the patient was cured of curvature a year ago, but, &c."

Besides relieving the deformity muscular exercise has many striking effects on the body generally. Exercise increases the metabolism of the muscular tissues and therefore the amount of heat in them. They then consume more oxygen, making the blood more venous and less arterial. This causes an increase in the movements of respiration, which, in its turn increases the flow of blood through the lungs and quickens and strengthens the heart-beats. The same changed condition of the blood also causes the blood vessels in the skin to dilate, and the perspiration glands to secrete. Regular exercise, which systematically does all this, day after day, must and indeed does have a most important effect on the general health.

Thus the general nutrition of the body is improved partly from the increased demand for food, partly by the increased elimination of waste products, and partly by the raised body temperature.

The muscles have been called the



FIG. 33. Case of Curvature in a Boy from Excessive Use of Fret-saw.



FIG. 34. Same case after a Month of Exercises, and Using Saw in Opposite Hand.

“furnaces of the body.” If the muscles are ill developed the furnaces are burning low, and the body machine cannot do its proper amount of work. Exercise causes the furnaces to burn up again, and restores the efficiency of the machine. The beneficial effects which most persons feel after a course of Swedish movements, massage, or other form of muscle developing exercises are partly due to these causes.

Equally important too are the effects on the circulation and respiration. The strengthening of the heart muscle is not the least important part, and the effect of the increased respiratory movement on the development of the chest, is most marked. An inch or more in circumference of the chest is very quickly gained by simply practising deep respiratory movements. This increased chest development has a very marked remedial effect on spinal deviations. In fact, the efficacy of the different systems of movement cures may be gauged by their relative effects in enlarging the thorax.

It is quite impossible for those who are not in the habit of using a good system of physical development in the treatment of disease to appreciate how great a change such a measure brings about in these muscleless people. The results, without any other treatment, often appear to the uninitiated to be most wonderful.

For a very long time various surgeons have treated spinal curvature with muscular exercise. In Tuson's book before quoted, are pictures of very cumbersome exercising planes on which the patient lies while pulling on different weights or raising his own weight by means of pulleys. This treatment, with different modifications, has been in vogue up to the present time. Mr. William Adams published in 1887 a pamphlet in which a new exercising plane is represented, and exercising planes figure in the price lists of various orthopædic instrument makers.

There is a good deal to be said for performing exercises in the recumbent



FIG. 35. Case of Curvature Resulting from Injury to Right Knee at Football, and Subsequent Chronic Rheumatism in it.

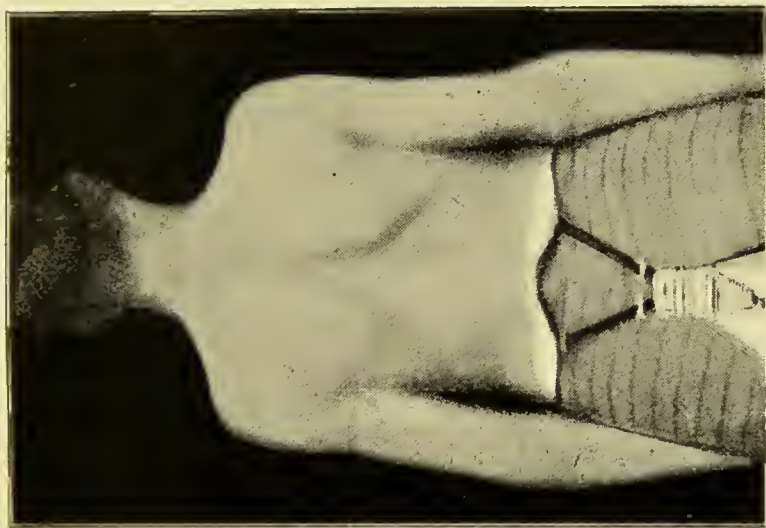


FIG. 36. Same case after six weeks of Muscular Exercises.

position, but nothing good can be alleged in favour of continual recumbency as a treatment of spinal deviations. The latter could only conduce to more muscular wasting.

The recumbent position, either prone or supine, tends, more or less, and in slight cases entirely, to temporarily obliterate the rotation. This it must do if rotation is due to the unequal action of muscles in stooping, for in recumbency the stooping is absent—that is to say, the weight of the head and shoulders is taken off the spine. The muscles will therefore be exercised gently without having to maintain a weight to which the deformity has shown they are unequal. In the system advocated, it will be seen that the first series of exercises are to be performed in a recumbent position, and that it is only as the muscles become stronger that exercises in the vertical position are ordered. It is not advisable to perform the whole course lying down, because this is a slower method of cure than when the vertical

is used in conjunction with it, provided the patient does not become too tired.

Mr. Bernard Roth is the surgeon who has however done most to put the cure of spinal curvature by exercises on a firm basis. For many years he has been carrying out this treatment with great success.

He gives the following principles as those on which the cure of curvature should be carried out.

“(a) Re-education of the patient's muscular sense as to an erect or improved position.

“(b) Improved position to be maintained at all times, while sitting or standing.

“(c) Attention to dress.

“(d) Systematic training of the spinal and other muscles, including the development of the thorax.

“(e) Attention to the general health.

“(f) Subsequent home treatment to prevent relapse in the improvement or cure that has been obtained by the surgeon.”

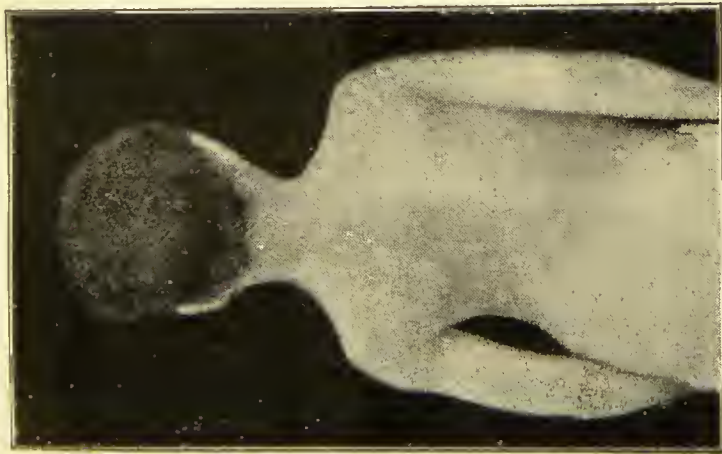


FIG. 37. Case of Double Latera Curve.



FIG. 38. Same case in "Keynote" Position.

For purposes of discussion (*a*) and (*b*) may be taken together. There can be no doubt of the good effects produced by making the patients maintain as good a position as possible when sitting or standing. The only question which arises in connection with this is the possibility of doing so. It must be remembered that these patients are crooked chiefly because the muscles are not strong enough to hold the patient straight. If by continuous voluntary effort the patient is made to do so, it is only another way of saying that the weak muscles, the muscles in fact which are at fault, must be induced to make extraordinary efforts. If this idea is not carried too far, that is, if the weak muscles are not too much over-worked, the continual reminder to move to an improved position becomes really a form of exercise. So far it is good, very good. If, however, the child is being continually goaded to make efforts for which the muscles are unfit, by constantly being nagged at to "hold up,"

"sit straight," &c., atrophy of the weak muscles is more favoured than their development.

Again, "the re-education of the patient's muscular sense" is hardly a correct way of expressing the matter. Muscular sense has not been lost or perverted. The sense of the position of the spine is due to the state of tension of the muscles and their tendons. If this is equal on both sides of the spine, the patient feels straight, and a normal individual will under those circumstances be so. If, however, as is the case with patients suffering from curvature, the muscles are of different lengths on the two sides of the spine, then when the tension of the two sides is equal, the patient will feel straight, when as a matter of fact he is, and indeed must be, crooked. To argue then that the muscular sense must be re-educated, is only the same thing as saying that improved position must be maintained at all times. The two are one and the same, and they form a good



FIG. 39. Case of Curvature in a Boy of 16 years, caused by leaning on too low a Desk at School.

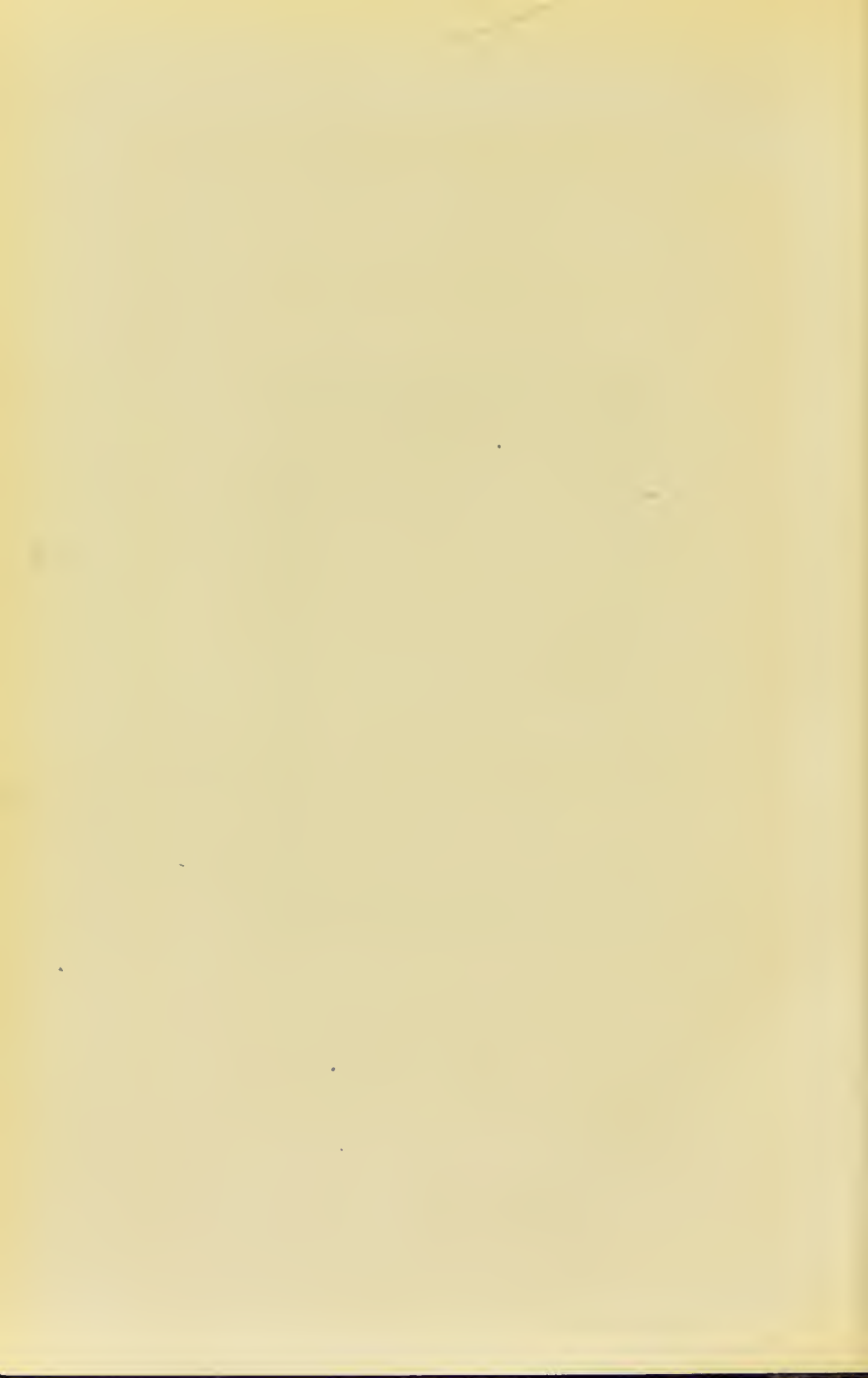


FIG. 40. Same case after one month of "Home Exercises."





FIG. 41. His usual Position at Lessons.



but monotonous exercise if not carried to excess.

For lessons and for music, Mr. Roth recommends the Glendenning school desk and seat, and the Glendenning patent music chair. These well known contrivances, now so much used in schools, give a firm support for the back as far as the scapulæ, support the feet, and keep the pupil at the proper height as regards the desk or piano.

(c) With regard to clothing, Mr. Roth makes an important point of having the dress and undergarments sufficiently loose in front to allow of expansion of the chest. The patient should "stand against the wall with head back and heels touching it, and with the shoulders well thrown back. While in this position, her mother or friend should try to fasten her stays and clothes in front." In most cases they will not meet by one or more inches, and should accordingly be altered to that extent to allow of the temporary thoracic expansion thus produced, becoming permanent.

(*d*) Systematic training of the spinal and other muscles, including the development of the thorax. This is the essential part of the treatment. As has been said previously, the development of the thorax alone has a remedial effect on the deformity and on the general health. Systematic training of the muscles, that is, their physical development, has also a marked and beneficial effect on the deformity, and the treatment is based on sound pathological reasoning. It has the advantage of beginning in a mild way and is, therefore, perfectly safe.

The following are the twelve exercises with which the course begins :—

1. Lying on back ; arms by the side of body ; palms upwards ; slow, deep inspiration by the nose ; slow expiration by the mouth. (Repeated four times.)
2. Similar exercise with the arms extended upwards by the sides of the head. (Repeated four times.)
3. Same position as 1 ; head rotation on axis to right and left alternately ; also lateral flexion of head to right and left alternately. (Repeated four times.)
4. Lying on back ; simultaneous circumduction of both shoulder-joints from before backwards ; elbows and wrists kept extended. (Repeated twelve times.)
5. Lying on back ; one hip circumduction both ways knee kept extended. (Repeated ten times.)
6. Lying on back ; simultaneous extension of arms up-

wards, outwards and downwards, from a position with the elbows flexed and close to the trunk. (Repeat four times.)

7. Lying forwards; one hip circumduction both ways; knee kept extended. (Repeated ten times.)

8. Sitting on couch, with back at an angle of 45° ; ankle circumduction down, in up and out, while the toes are directed inwards the whole time. (Repeat twenty times.) Also foot adduction, patient resisting; abduction, surgeon resisting. (Repeated eight times.)

9. Lying on back, with arms extended upwards by the sides of the head; flexion of both arms, surgeon resisting by grasping the hands, followed by extension, patient resisting. (Repeated six to eight times.) The patient's knees, flexed over the end of the table, fix his trunk.

10. Patient astride narrow table or chair without back, with arms down and hands supinated; trunk flexion at lumbar vertebræ, patient resisting slightly, followed by trunk extension, surgeon resisting by his hand against back of patient's head. (Repeated six to eight times.)

11. Patient, with arms extended upwards, stands with head, back, and heels against a vertical post with pegs on each side, which he grasps. The surgeon gently pulls the patient's pelvis forwards by his hands on the sacrum, patient resisting; then the patient moves back the pelvis to the post, surgeon resisting. At no time are the patient's heels to be raised from the floor. Also pelvis rotation on its axis to right and left alternately, surgeon resisting with his hands on each side of the pelvis. (Repeated six to eight times.)

12. Lying on back, with head and neck projecting beyond the end of the table; arms by the side of the body, palms up; the head is gently flexed by the surgeon's hand on the occiput, patient resisting, followed by head extension, surgeon resisting. (Repeated eight times.)

N.B.—Patient to count aloud during all exercises, except 1 and 2.

And to these after a few days are added others of more severity.

(e) Finally a few other exercises are given for home use to prevent relapse where cure or the limit of improvement has been obtained.

Mr. Roth draws attention to the fact that for every case a certain maximum of temporary improvement may be shown by placing the arms in certain positions. These positions he calls the "keynote" positions, because, he says, they give the keynote of the exercises to be performed. How the exercises are to be worked out from the "keynote" remains apparently a mystery. Taking the most common keynote position, viz., that with the left arm up by the side of the head and the right out at right angles from the body, one cannot but wonder where the keynote is. The appearance of deformity is thus removed chiefly by putting the lower part of the trapezius and the upper part of the latissimus on the stretch on the left side. Moving out the arm on the right side makes the scapula less prominent, and the contraction of the upper portion

of the trapezius prevents a cervical curve with concavity to the right. Other muscles, of course, help, but these, the chief, are sufficient to mention for the purpose. Now, how can this abnormal position, this abnormal stretching of muscles, give a "keynote" of exercises? It could not even be a keynote if it showed that these muscles were shortened or lengthened.

Exercises might shorten or lengthen them to a large extent, but these alterations would be more likely to affect their insertion to the movable arm, than their origin from the comparatively fixed spine and its adjuncts. In fact, "the keynote" is not a keynote at all. Very much more would be learnt from a study of the position of maximum deformity than from one of minimum deformity.

The position of maximum deformity gives the amount of rotation and lateral deviation, which the surgeon has to counteract, and the measures necessary to be taken can be calculated with fair

approach to accuracy. The keynote or position of minimum deformity gives neither of these necessary details. Again, Mr. Roth says, the patient should be exercised in the "keynote" position. He, however, gives no details as to what exercises the patient is to perform, with one arm vertically up at the side of the head and the other out at right angles.

In spite, however, of these criticisms, there is no doubt but that the general principle of treatment of curvatures by muscular exercise is the necessary treatment in all stages of the disease, whatever other adjuncts in the way of supports or other instruments may be required in the different stages. Although owing to Mr. Roth's writings and to the results of his cases this fact is now almost universally recognised, yet it is not necessary to accept entirely all the details of the system of exercises which he advocates.

So little, however, have his principles permeated general surgical practice, that

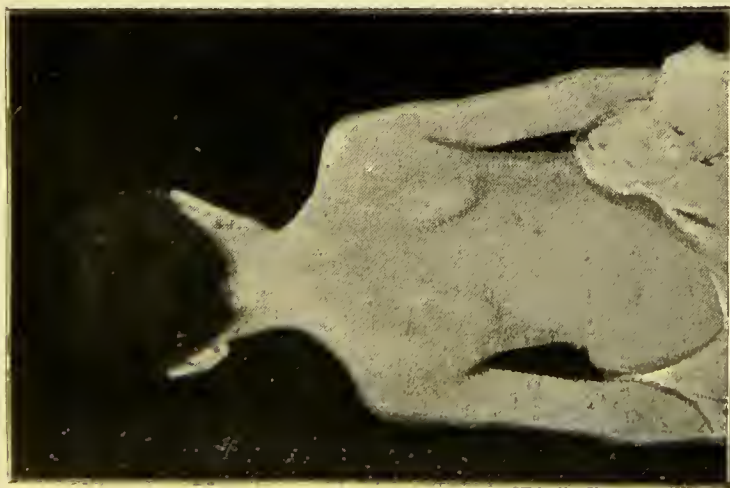


FIG. 42. Case of Curvature in a Boy
with Adenoids.

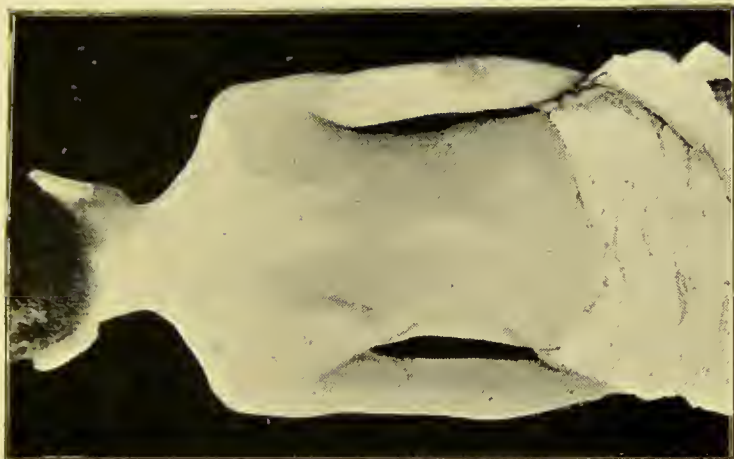


FIG. 43. Same case after Removal of
Adenoids and six weeks of
Muscular Exercises.



cases of spinal curvature are not admitted into London hospitals, and there is no hospital possessing even the most rudimentary gymnasium. The usual hospital treatment resolves itself into a tonic and a poroplastic or other form of jacket. Paris is somewhat in advance, as one hospital has a well-appointed gymnasium, viz., the "Hospice des Enfants-Assistés" in the clinic of M. Kirmisson, and a less complete one has recently been added to the clinic of M. Brun in the "Hospice des Enfants Malades." At the Victoria Hospital, Folkestone, to which the writer is attached, there are two Dowd's machines, with which much useful work is done. As, however, the number of persons suffering from spinal deviations is so large, it seems a reproach that more efforts are not made to induce hospital committees to increase the use of their institutions by the addition of small gymnasia.

Exercises, it may be repeated, have the following results :—

(1) Great improvement in the general health.

(2) They remove one cause of the deformity, viz., weak muscles.

(3) They develop the thorax, the contraction of which is part of the deformity, and at least cure so much of the general abnormality.

By the use of symmetrical exercises this much is possible even in advanced cases, such as fig. 19, where the difference in the length of the muscles on the two sides of the spine is so very great.

In addition, by using asymmetrical exercises much more is rendered possible, viz., greater improvement or even cure of the deformity. One cannot expect to make unequal muscles equal by applying the identical exercises to both. Both would be improved but they would still be unequal in point of strength. As Euclid says: "If equals be added to unequals, the results are unequal, but if unequals be added to unequals, the results are equal." In

other words, by exercising the weak muscles of one side more than the corresponding strong ones of the other side, both will be brought up to the same standard. Hence another of the causes of curvature, viz., the unequal action of the muscles of the two sides of the body will be done away with.

The exercise treatment is required through all stages of the disease, and must be kept up afterwards to prevent any tendency to recurrence. It is necessary as a preventive measure in children of weak muscular development, and it is equally necessary for an adult with a confirmed incurable curvature, to preserve the general health. In cases without alteration in the shape of the spinal bones, a proper combination of symmetrical with asymmetrical exercises can always effect a cure. In more advanced cases supports must be worn, but exercises are still necessary to enable the muscles to hold the spine in the improved position, when further improvement by the use of the instrument has

become improbable. Without exercises the instrument would have to be worn for life.

As a means of promoting muscular development in all but the very feeblest, there is in the writer's opinion nothing so good as Dowd's machine, or those made on the same principle. It consists essentially in a pair of weights having ropes with handles attached. Each rope passes over a pulley. The weights rest on a bracket, from which they can be easily removed, and the brackets move easily up and down in grooves when the ropes are pulled on. By this means it is possible to pick out various sets of muscles and exercise them, without exercising the opposing muscles. Thus, if the patient stands opposite the machine, with arms straight out in front, hands grasping the handles, then separates the hands horizontally outwards as far as possible, the back muscles concerned in this movement will be considerably exercised by having to raise the weights to a certain height.



FIG. 44. Dowd's Machine.

In returning to the original position however, the muscles causing this movement will be so helped by the falling weights that they will practically not be exercised at all. In the same way, one erector spinæ may be more exercised than the other by turning the side to be exercised away from the machine and making movements causing it to lift the weights.

In commencing exercises with Dowd's machine, only the brackets which are of light weight are used. Gradually as the strength increases more weights are added. If it is advisable to do so more weights can be added to one side than another. Thus it can be seen how easily the question of asymmetrical movements can be solved by this machine.

There can be no doubt but that exercises affecting the muscles also to a greater or less degree, according to the amount of alterations in them, also affect the ligaments. If it were possible in a case of spinal deviation to name exactly

every muscle abnormally affected, and to measure exactly the amount of that abnormality, it would be fairly easy to prescribe at once the necessary exercises and to accomplish a rapid cure. Unfortunately, there exists at present no known means of measuring the muscular abnormality so accurately, and one must therefore be content with cruder methods. Seeing, however, that muscles mostly work in groups, nearly every movement being compounded of the joint action of several muscles or parts of muscles, the methods may not be so very crude after all.

The lumbar curve may be acted on by such exercises as series D 5, 6, and F 2, in which the muscles on convex side are exercised and strengthened. The dorsal curve, too, may be affected by other asymmetrical exercises such as series D 3, 4, and L 3, 4. A very noticeable effect of an asymmetrical exercise is seen in the oft-quoted instance of the right dorsal curve of a blacksmith, and also in the case of the nursemaid always

carrying a heavy child on the right arm. With the blacksmith and the nursemaid the treatment would chiefly be to make them perform their occupations with the left arm instead of the right. Where there is definite history of a one-sided employment the treatment is simple. It is not often that the cause can be so easily made out, especially as in most of the cases general muscular weakness introduces so many other factors. Fig. 47 represents the back of a young woman who acts from ten in the morning to eight at night as clerk in a large business. Here, writing is obviously the cause. She gave a history of always writing in the classically bad position. In this case she had no time for a course of exercises in a gymnasium, and therefore a support had to be worn until such time as exercises could be arranged for. The support supplied was one of those recommended by Mr. Noble Smith. It had the advantage of preventing the possibility of writing any more in such a bad position. The

better treatment would have been to have generally developed her muscles, specially to have worked at the rotation exercises, and to have well developed her thorax to do away with her stoop.

The rotation exercises, series G 6 and 7, are the reverse of each other. Either is chosen, according to which way the rotation has taken place.

To sum up, then : there are means of acting on the lumbar curve, tending to cause it to become right or left at will. There are means of acting on the dorsal curve, in the same manner. It is possible also to act on the cervical curve by asymmetrical movements of the head. Rotation can be influenced by exercises. The chest can be developed and stoop removed. The cause of the spinal deviations in those cases not depending on organic lesions can be removed.

These are truly powerful means. It is only necessary to learn how to combine them to the varieties of curvatures, not a very difficult proceeding when one has learnt the value of the means at hand.



FIG. 45. Exercise for Left Erector Spinae, First Position.



FIG. 46. Exercise for Left Erector Spinæ, Second Position.



To give examples; in the case of a general curve convex to the left in a muscleless person, general muscular exercises would be required. If this did not rapidly cure it would be necessary to exercise the left erector spinæ only, leaving the right alone. Exercises Series D 4, I 3b, &c., would be required, working up the right arm in excess of the left, and adding rotation exercise Series G 7.

In fact the following would be the exact prescription:—

Series A 1, 2, 3; B 1, 2, 3; C 1, 2, 3; D 1, 2, 4, 5; E 1, 2, 3; F 1, 2 (D 4 and 5); G 1, 2, 3, 5; H 7, 8, 9, 10, 11, 12; I 1, 2, 3b; J Face to machine exercises; L 3, 5; M 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11; P 1, 2, 3; Q 1, 3; R 2; S.

In the case of a double curve convex to the left in the lumbar, to the right in the dorsal, and again to the left in the cervical, asymmetrical exercises would have to be combined with the symmetrical, and would be essential. Thus

the right erector in the lumbar region would have to be exercised, and the left arm and the right side of the neck. Some exercises would depend on the comparative lengths of the different curves, but the following prescription would be nearly right for most cases of this combination of curves :—

Series A 1, 2, 3 ; B 1, 2, 3 ; C 1, 2, 3 ; D 1, 2, 3, 5 ; E 1, 2, 3 ; F 1, 2 (D 3, 5) ; G 1, 2, 3, 5, 6, 8, 9, 10, 11, 12 ; V (note).

A rough classification for purposes of treatment can then be made, which, if carried through the whole course as described in the next chapter, will give good results. It must be understood, however, that the special results obtained will become better in proportion as the exercises for each patient are carefully worked out from a study of each individual case, and also according to the amount of personal supervision given by the surgeon in the carrying out of the treatment.

Those, however, who will only follow

out the general plan as set forth in the appended classification, will obtain results which the author ventures to think the general practitioner has not previously had in his power to bestow.

The following is the classification referred to :—

- (1) Left lumbar, right dorsal, and left cervical.
- (2) Right lumbar, left dorsal, right cervical.
- (3) Left lumbar, left dorsal, right cervical. (General curve to left.)
- (4) Right lumbar, right dorsal, left cervical. (General curve to right.)

N.B.—These are all associated with various degrees of rotation.

And here it may be as well to mention, since it is a matter of great importance, that the development of the muscles by means of exercises does not necessarily imply “violent” exercises. Many parents associate the idea of gymnastics with violent exertion. So common is this error that the writer has

for a long time been in search of a word which will imply a milder form of exertion, but up to the present without success. As a proof of the non-necessity for violent exertion, Sandow, who is the strongest man this century has seen, developed his muscles by the use of 3 lb. and 5 lb. dumb-bells. A visit to the medical gymnasium, which Folkestone most fortunately possesses, dispels at once the delusion that gymnastics must necessarily imply violent exercise, when it exists locally among the parents.

The modern gymnasium offers facilities for building up the body, which are not excelled by any other system of exercise. The introduction of the new developing appliances has opened up the possibility of the gymnasium to many to whom it was before of doubtful value. The pupil is no longer compelled to compete with others in the performance of feats that are distasteful to him. He can now compete with himself, that is, with his own physical condition from week to week, and from

month to month. The weights can be adjusted to those best suited to his requirements. If he is weak in the chest or back he can spend his time and energy in strengthening those parts, without fear of strain or injury. By passing from one apparatus to another, and by keeping always within his capacity, he adds slowly and surely to his general strength and powers of endurance.

It has been found by experience that there are certain principles which have to be borne in mind in attaining muscular development. They are as follow :—

(1) That a thorough examination should be made of the patient, and the less developed parts noted. These alone should be first exercised, so that they may be brought up to their proper ratio to other parts. Then all should be developed together. Examinations taking place at certain intervals.

(2) That both sexes should commence at 10 years old, but less regular

exercises and easier movements, such as games of musical chairs, dancing, &c., may be commenced at a much earlier age.

(3) There should be plenty of variety in the exercises, and no set of movements should be continued for more than for five to eight minutes. The muscles are thus kept healthily occupied by diversity of work, and a large number of muscles, involving symmetry, are gently exercised. In class work every exercise possible should be performed to music.

(4) As the pupils get older and stronger, harder work may be indulged in, such as rings, parallel bars, horizontal bars, climbing ropes, poles, &c.

(5) There should be a short rest between each exercise.

(6) The exercises should be arranged so as not to be a burden to, but rather to excite the interest of the child.

(7) The exercises should cease before symptoms of weariness are induced.

(8) Exercises should take place in a



FIG. 47. Curvature Caused by Writing for Hours daily
in a Bad Position.



well-ventilated room or out of doors, and the duration of them being gradually increased, but in no case to last more than half an hour.

(8) No exercise must be performed during the menstrual period or for two clear days after.

(9) If possible, Sunday should not be allowed to interrupt the exercises. For as no exercises are to be performed during the menstrual period, a week in each month is thus lost, and if to this be added the four Sundays in the month, there will be ten or eleven days lost in each month, *i.e.*, one day in every three.

If added to this the patient is kept at home for rain, a cold, or other causes, the progress of treatment becomes retarded.

Lordosis and Kyphosis.

From what has been said of the influence of stooping on the formation of lateral curvature, it will be obvious that cases of lateral curvature are mostly

kyphotic. In cases of pure kyphosis, where there has been no disturbance of the equal action of the muscles on the two sides of the body, and the bad positions have been mesial rather than amesial. A cause of this may often be found in the fact that the patient has had sufficient leg exercise to keep the pelvis mesial, and has not had to carry weights such as school books on one side of the body more than on the other. Often too, the cause of the kyphosis, as Mr. Roth has pointed out, may consist simply in the fact of the clothes being too tight in front. The treatment of a pure kyphosis is comparatively simple. The chest must be released by having the clothes loose in front, and a course of ordinary drilling may alone be successful. If access to a gymnasium is possible, exercises at Dowd's machine with the face to the instrument will strengthen the dorsal muscles and enable the patient to hold up automatically. The ligaments, too, may be



FIG. 48. Case of Lordosis.



stretched by making the patient perform chest expanding exercises at the quarter-circle machine. These measures will rapidly affect the dorsal part of the curve. To reach the lumbar portion special leg exercises such as series A₂, B₂, C₂, D₂, F₁, should be freely used. These exercises act on the psoas and iliacus, and the higher the leg is raised the more efficient is the exercise.

Cases are, however, occasionally met with where lordosis is associated with lateral curvature, and unless early remedial measures are applied, the deformity appears to increase with far greater rapidity than when kyphosis is present.

Lordosis may be secondary to other disease or deformity such as congenital dislocation of the hips, from spasm or contraction of muscles, from pseud-hypertrophic paralysis, from talipes equinus, from caries of the spine, or from hip joint disease.

When, however, lordosis exists alone, not secondary to any of the above, it is

mostly due to rickets. Conversely most cases of rickety scoliosis are combined with a more or less degree of lordosis. This may be due to the increased thickening of the margins of the bodies of the vertebræ having more effect in the lumbar region. It is probably, too, connected with alterations in the relative shape and weight of the head and possibly too with the increased weight of the liver. In fact, there is too much weight in front of the line of the centre of gravity, causing the child to throw the upper part of the body backwards, much as the man does who plays the big drum in a military band. There may be, however, another cause. The bellies of rickety children are prominent and distended, very much more so than the lordosis will account for. It is, in fact, due to chronic indigestion and flatulence. The backward throw of the shoulders may be due to the effort to relieve the heart from the pressure of the flatulent distension. Probably all three causes contribute in different

degrees. While treating the case by exercises of the hamstrings, glutei, and abdominal muscles, the causative rickety condition must receive attention.

CHAPTER V.

A SYSTEM OF MEDICAL EXERCISES, BEING
A COLLECTION FROM VARIOUS SOURCES.

Preliminary Notes—Home Exercises, Lying Down, Against Support and Without Support—Asymmetrical Exercises—Flat-foot Exercises—Exercises with Dowd's Machine—Exercises with Gymnasium Apparatus—Wheel Exercise—Exercises for Acting on the Spinal Ligaments—The Oblique Ladder—Parallel Rings—Vertical Pole or Rope—Trapeze—The Gridiron—Dumbbells—Exercises for Bow-legs and Knock-knee.

THE following system of exercises is designed to improve the general health, to remove some of the causes of curvature, and to cure or improve the deformity. For the first object they are useful for a large number of various conditions occurring in individuals of

almost any age, not necessarily the subjects of spinal deviations. It is not intended that every case shall perform all the exercises. The system is intended to present rather a *materia medica* of exercises, from which the surgeon can prescribe those which he considers best for each case. The cases will always have a large number of symmetrical exercises, but the number and kind of asymmetrical exercises will be prescribed according to the degree and direction of the deformity.

Generally the exercises should be performed twice daily for a period not usually exceeding half an hour. Children must be made to learn the exercise gradually, two or three new ones being added at each lesson as the previous ones are learnt and well done. The chief advantage of the following system is, that the essential part of it may be done at home. Before practising the exercises, however, the patient and one of his relations, if the patient is a child, should be properly instructed by a

skilled person, *e.g.*, a doctor or a gymnastic master. More rapid progress is, however, made by having one of the daily lessons performed at a gymnasium, even where not more of the apparatus than would be fitted up in the patient's house is used. The patient will then be sure of having at least one lesson efficiently, properly, and regularly performed.

As the strength improves, more rapidity is obtained in the improvement by the use of the new developing machines.

The gymnasium is very advantageous, but the whole cure can be done at home, and need not interfere with lessons or any other business.

All the exercises herein detailed are meant to be performed with slowness, ease and grace, without jerking or holding the breath. No exercise is to be continued after the first feeling of fatigue is induced. There should be a rest between each, the length of which should depend upon whether the exer-

cise has been one requiring little or much expenditure of energy. It is advisable as far as possible to interpose an exercise inducing little force between two requiring more. In the different exercises a pause should intervene in moving from one position to another, and before commencing the following exercises, the patient must practise breathing properly. He must inspire as freely and deeply as possible through the nose, without strain, then, with the mouth open, expiration should follow at once without effort, being performed by the elasticity of the chest and lungs alone. Both movements should be easily and regularly performed and a short rest should follow each expiration. After each set of three double movements there should be a longer rest occupied by at least three ordinary breaths.

N.B.—Most of the exercises down to series G are taken from an article by Madame Nageotte - Wilbouchewitch published in the *Presse Médicale* of October 14, 1896.

HOME EXERCISES.

These exercises commence with very mild ones and gradually work up to ones requiring more strength.

The first are performed lying down either prone or supine. The next series are made leaning against the wall or other support. The patient then performs the same exercises standing without support. This order is taken because the patients are mostly too feeble at first to do exercises standing for more than a few minutes and therefore tend to assume bad positions. The recumbent position as before remarked, is a good one for redressing the curves. In arranging the patient perfectly straight some assistance may be derived from the pattern of the carpet or the lines on the floor. The upright exercises should be performed before a glass.

Dollinger, of Buda-Pesth, fixes black tapes across the glass which then act as lines of mark. This is a very useful addition as it enables patients to place

themselves in a mesial position and easily makes evident to them any inequality of the height of the shoulders or of the subaxillary spaces.

SERIES A.—LYING ON THE BACK.

General Instructions.—The patient lies down on the floor or table, heels together, shoulders at the same level, head straight, arms extended by the side of the body, palms facing upwards. The shoulder blades are to be pushed back so as to expand the chest, and the whole posterior surface of the body should be applied to the surface of the table so as to efface the lumbar bend as much as possible.

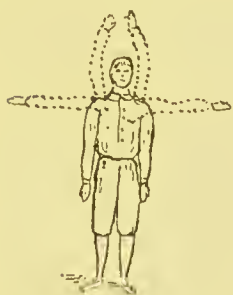


FIG. 49.

1. — *Arms in three positions.* — (a) By the sides of the body. (b) Straight out, forming a cross with the body. (c) By the side of the head touching the ears, and as straight as possible. Breathe

while resting in each attitude. Return in the same manner to the position of rest.

These movements will exercise the pectorals, all the muscles attached to the scapulæ and latissimi dorsi.

2.—Raise each leg to the vertical, knee kept straight ; return to the position of rest, the other leg immovable. Exercise of the psoas and iliacus and quadriceps, extensor.

3.—Bend the head to each side so that the jaw rests on the ground ; return slowly to the position of rest without moving the shoulders. The arms must be kept immovable, palms upwards. Exercise of rotators and lateral flexors of head and neck.

SERIES B.

General Instructions.—Same position as above, except that in each case the movement starts from the following position : the elbows close to the side, forearm bent upon the arm, fists closed,

with the thumb side to the shoulder.



FIG. 50.

1.—(a) The length of the body. (b) In a cross. (c) Vertically upwards. (d) By the sides of the head.

Exercise of biceps, and triceps, scapular and pectoral muscles, and latissimus dorsi.

2.—Move out each leg transversely, knee kept straight, the other leg immovable, return to the position of rest. Exercise of thigh muscles and muscles passing from pelvis to great trochanters.

3.—Bend the head until the chin touches the chest, return slowly to the position of rest. Exercise of sternomastoid, anterior neck muscles, and splenius, complexus and posterior neck muscles.

SERIES C.

1.—*Circular turn of the arms.*—The palm upwards, the arms describe a half circle on the earth to rejoin at the sides

of the head. There the fingers cross each other, the patient stretches out as far as possible, and brings the arms back parallel to the side of the body by describing a half circle in a vertical plane. Exercise of all the muscles attached to the scapula and upper end of the humerus.



FIG. 51.

2.—*Circular movement of the leg.*—

The leg held straight is lifted vertically carried outwards to the earth, and returned to its place. All the rest of the body immovable. Exercise of psoas and iliacus and all muscles of the thigh including those passing from the pelvis to the femur, and sartorius.

3.—*Circular movement of the head.*—

The head is first bent forwards until the chin touches the chest, then the head is inclined in such a manner that the ear touches the shoulder; return to the position of rest in the same level. Repeat, inclining the head to the oppo-

site side. Exercise of the muscles on each side of the neck.

SERIES D.

1.—Sit up without the aid of the arms, the back straight, the head stretched out. Lie down again very slowly without bending the back. Exercise of the psoas and iliacus and of anterior abdominal muscles chiefly.

2.—Lift the legs stretched very slowly as far as the vertical, Lower them slowly. Exercise of psoas and iliacus and anterior thigh muscles.

3.—Place the right hand on the ribs as high up and as far back as possible thumb forwards.



FIG. 52.

Place the left forearm on the head so that the left fingers touch the right ear. Bend all the body above the right hand as far as possible to the right. Take a few deep inspirations and return to the symmetrical position. Exercise for right dorsal curve.

4.—Repeat the preceding exercise in a reverse manner. Exercise for left dorsal curve.



FIG. 53.

5.—Arms in a cross. Legs and hips immovable, head straight. Bend the whole body to the left. Remain during a few inspirations. Return to the position of rest. Exercise for right lumbar curve.

6.—Repeat in the opposite direction. Exercise for left lumbar curve.

SERIES E.—LYING ON THE STOMACH.

1.—Arms strongly stretched at the sides, raise oneself, breathe. Exercise for erector spinæ.



FIG. 54.

2.—Lift each leg stretched. Perform circular movement. The head rests on the jaw of the side of the limb lifted. Exercise of thigh muscles, glutei, extensors and rotators.

SWIMMING MOVEMENT.

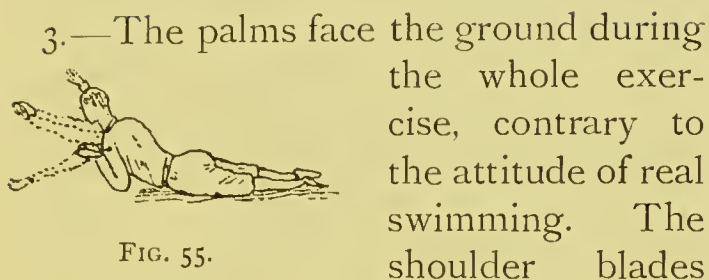


FIG. 55.

3.—The palms face the ground during the whole exercise, contrary to the attitude of real swimming. The shoulder blades are not to move on the chest. The elbows and hands are not to touch the ground so as to avoid passive supporting. To rest, the patient lies down completely. Exercise for erector spinæ, latissimus dorsi, scapular and pectoral muscles.

SERIES F.—EXERCISES, DONE IN THE UPRIGHT POSITION WITH SUPPORT.

General instructions.—The patient either simply leans against the wall, or at first is held there by a strap round the waist until he can hold himself upright without support. More muscles, viz., those required to maintain the erect posture will be brought into play, and the exercise will thus be more severe.

1.—The first three series of movements, viz., A, B, and C, are then done in this position.

2.—Then D, 3, 4, 5 and 6. No. 5 may, however, be carried still further in this position, viz., until the fingers touch



FIG. 56.



FIG. 57.

the ground. (a) By the placing legs apart and bending the left knee, or, (b) By allowing the right foot to leave the ground so that the body see-saws on the left hip joint.

SERIES G.—MOVEMENTS MADE WITHOUT SUPPORT.

All the movements which have been done against the wall should at last be performed without such help ; also

1.—*Breathing*.—Hands clasped behind the waist, inspire, hands still clasped but arms forcibly stretched downwards, expire.



FIG. 58.

2.—*Flexion of trunk*.—Head straight, arms extended at sides of the head, bend the trunk forwards from the hips, so that the fingers, united by their palmer surfaces touch the ground; return to the previous attitude with the arms in the same position. The legs to remain very straight, the feet a little apart. The repetitions of the movement to be separated by circular movements of the arms. Exercise of anterior abdominal, erector spinæ, glutei, psoas and thigh muscles.

3.—Sit down slowly upon the heels with the arms extended horizontally in front; recover to the standing position while letting the arms fall. Exercise of thigh, glutei and erector spinæ muscles.

4.—Bend the trunk forwards, backwards, laterally, and lastly circularly, the

hands resting on the hips. Exercise of anterior, posterior and lateral abdominal muscles, and erector spinæ.

5. Separate the arms horizontally backwards as far as possible with inspiration; bring them together in front with expiration. Exercise of pectorals, scapular muscles, and latissimi dorsi.

6.—*The untwisting exercise.*—Patient standing, the arms straight and horizontal, and inclined as far as possible to the right, are rapidly moved across the front of the body as far as possible to the left; the whole spine at the same time rotating to the left. Thus the hands describe about $\frac{3}{4}$ of a circle in a horizontal plane. Maintain this position for a few moments, then allow arms to fall and the spine to come into a position of rest. Exercise for rotation to the right.

This is one of the most important and powerful of the asymmetrical movements. Its power is much increased by using the Dowd's machine.

7.—Reverse the exercise. Exercise for rotation to the left.



FIG. 59. The Untwisting Exercise, First Position.



FIG. 60. The Untwisting Exercise, Second Position.

8.—*For poking of the chin.*—Patient sitting. Slowly bend head forwards until chin touches chest, then rapidly bend backwards as far as possible. Maintain the position a few seconds; return slowly to position of rest. Exercise of complexus, trapezius, splenius, &c.

9.—Patient sitting; arms by side, simultaneously draws back both shoulders as far as possible, keeps them in this position whilst he counts four, and then allows them to return to original position. Exercise of scapular and latissimus muscles.

10.—Patient sitting; bends the body on to the thighs, then slowly rises again. Exercise of anterior abdominal, psoas and iliacus, and erector spinæ muscles.

11.—Patient standing opposite a wall and an arm's length from it, stretches out the arms horizontally in front, and applies the hands flat against the wall; without moving his feet the patient slowly approaches his body to the wall by bending the arm on the forearm; then he slowly recovers.

This passively expands the chest and causes contraction of the shoulder and arm muscles on both sides.

NOTE.—All the preceding exercises are at first made by the patient alone. By interposing resistance to the muscular effort the efficacy of the various movements can be increased at the will of the surgeon as the patient increases in strength.

12.—The patient is seated in a chair with a straight back, reaching as high as the shoulders, a band fixing the trunk to the back. The patient's back

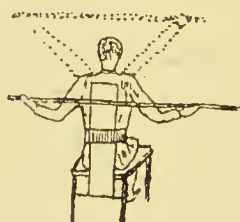


FIG. 63.

and shoulders should be firmly applied to the back of the chair. A rod or stick, about four feet long, is then grasped firmly by the hands, about two inches or more from the ends, and raised above the head, the hands still remaining the same distance from the ends. The rod is next lowered behind

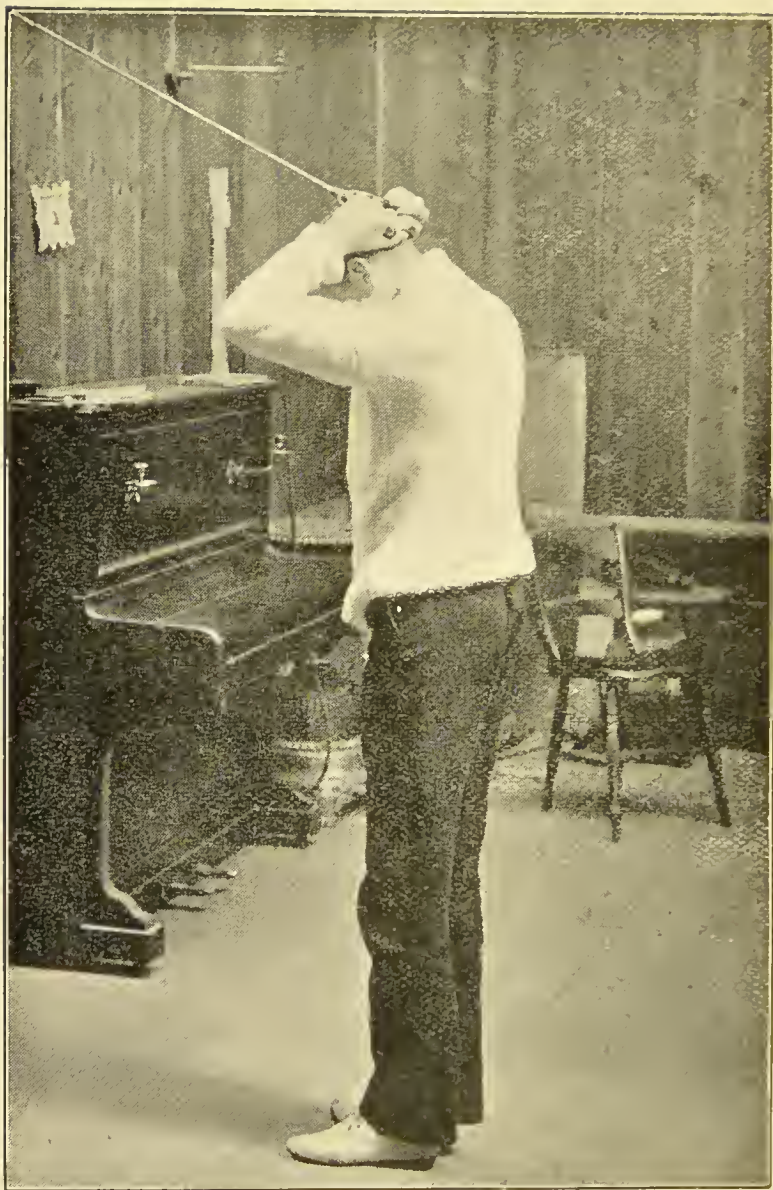


 FIG. 61. Exercise for Muscles at Back of Neck, First Position.



FIG. 62. Exercise for Muscles at Back of Neck, Second Position.

the back of the chair as far as possible. The hands must still retain their position on the rod, but the elbows must be bent. Alternately raise and lower.

NOTE.—As the patient gets stronger the band will be unnecessary.

This is also a chest expanding exercise, calling into action the muscles on front and back of the chest.

SERIES H.—FLAT FOOT EXERCISE.

I. — Patient standing, raises himself on his toes, remains there while



FIG. 64.

counting three slowly, then slowly returns to former position. (Fig. 64.)

2.—Patient standing, raises the toes, putting his whole weight on the heels ; return to former position. (Fig. 65.)



FIG. 65.

3.—Patient sitting, performs same movements. Also circular movements of the foot from right to left and *vice versa*.

4.—To walk about on the toes.

5.—Resistance may be added to 1, 2, and 3, and number 4 may be performed carrying weights in each hand.

SERIES I.—EXERCISES OVER THE EDGE OF A TABLE.

1.—Lying down flat on the stomach on the table. The legs fixed by a strap

across the ankles, the trunk going beyond the table as far as the hips. The arms stretched behind the back,

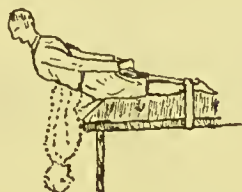


FIG. 66.

bend the trunk down as far as the vertical, raise the head first then recover slowly, stretching the arms forcibly and breathing deeply to the maximum of recovery. Repeat three times in succession. Rest, then repeat six times slowly. To rest, rise on to the knees on the table.

N.B.—If the curvature is bad, extension must be limited to rising to the horizontal line.

Exercise chiefly of the erector spinæ and its continuations.

2.—Sit at the edge of a table with back at edge, and feet retained by a strap, then head and back straight and arms stretched behind the back, slowly

lie down, breathe, return to the first position.

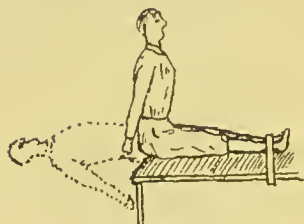


FIG. 67.

NOTE. — Until strong enough the patient must be supported through this exercise. The back must be kept straight, not rounded.

This is an exercise chiefly of the anterior abdominal, psoas, and iliacus, and front of thigh muscles.

3.—Same exercise lying on the side ; the concavity of the principal curve downwards. It is an exercise of over correction, which is very difficult to perform, and also to teach.

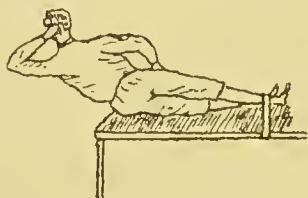


FIG. 68.

SERIES J.—WITH DOWD'S MACHINE.

NOTE.—In using Dowd's machine, the patient is to commence without any other weight than that of the weight carrier. Gradually weights are added as the doctor may direct. It may, for various reasons, be found necessary to add more weights to one side than to the other. For instance, in the face-to-machine exercises for a patient with rotation to the right, it would be well to place more weights on the right side than the left. In the back-to-machine exercises greater weight on the left would then tend to untwist.

1.—*Patient Facing Machine*.—Patient stands facing machine. Right hand straight out in front grasping handle of machine, is made to describe a circle in a horizontal plane, being carried as far back as possible. Return to original position.

2.—Ditto, left hand.

3.—Same exercise, both hands together. (Fig. 69.)

4.—Right hand held vertically up, grasping handle of machine, is brought down in front, describing a semi-circle in a vertical plane.



FIG. 69.

5.—Ditto, left hand.

6.—Ditto, both hands at same time.

7.—Right hand held vertically up and straight, grasping handle of machine, is brought down at the side describing a semi-circle in a vertical plane. Return to original position.

8.—Left hand ditto.

9.—Ditto, both hands at same time.

10.—Elbows bent and at sides of body, both hands grasping handles, arms to be alternately straightened and returned to original position. (Fig. 70.)

11.—Arms straight out in front, hands grasping handles, bend elbows and bring them back until they come to sides of

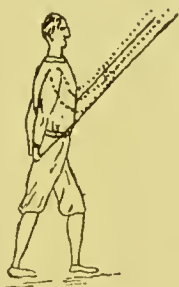


FIG. 70.

the body ; hands remain straight out. Alternately repeat and return to original position.

12.—Incline head towards machine, grasp one handle with both hands and hold it in contact with back of the head. Bend head as far back as possible from the neck, carrying handle and hands with it. Alternately repeat and return to original position. (Fig. 71.)

13.—Same exercise, but bending back and neck as far back as possible.

14.—Patient erect, holding handle and hands in same position ; bend for-

wards, bringing head as low as possible. Return to original position. (Fig. 72.)



FIG. 71.



FIG. 72.

15.—Right arm straight out from side, hand grasping handle. Hand describes a circle about a foot in diameter, its first position being the centre.

16.—Ditto, left arm.

17.—Ditto, both arms same time.

18.—The untwisting exercise, Series G 6.

19.—Ditto, Series G 7.

20.—Right arm straight out in front, the hand grasping handle is carried vertically upwards, then outwards, downwards as far as possible, and finally returns to original position after describing a circle.

21.—Left arm ditto.

22.—Both arms together ditto.

SERIES K.—PATIENT WITH BACK TO MACHINE.

1.—Series J. Number 1 reversed.

| | | | | |
|----|---|---|---|--------------|
| 2. | „ | „ | 2 | „ |
| 3. | „ | „ | 3 | „ (Fig. 73.) |
| 4. | „ | „ | 4 | „ |
| 5. | „ | „ | 5 | „ |
| 6. | „ | „ | 6 | „ (Fig. 74.) |
| 7. | „ | „ | 7 | „ |
| 8. | „ | „ | 8 | „ |



FIG. 73.



FIG. 74.

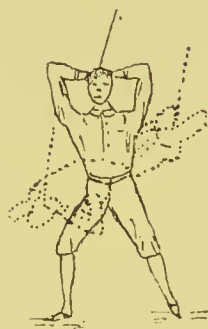


FIG. 75.

9.—Series J. Number 9 reversed.

| | | | | |
|-----|---|---|----|--------------|
| 10. | „ | „ | 14 | „ |
| 11. | „ | „ | 15 | „ |
| 12. | „ | „ | 16 | „ (Fig. 75.) |

13.—Series J. Number 17 reversed.

14. " " 20 "

15. " " 21 "

16. " " 22 "

SERIES L.—SIDE TO MACHINE EXERCISES.

1.—Right side to machine; arm straight out grasping handle is carried upwards to side of the head; returns to first position, pauses and is brought down to side; reverse; repeat.

2.—Left side to machine; same exercise for left arm.

3.—Right side to machine; left fore-



FIG. 76.

arm resting on head, left hand over right ear grasping handle. Patient

leans as far as possible towards machine, recovers and leans as far as possible away from it ; hips and legs immovable.

4.—Repeat with left side to machine, right arm over head.

5.—Repeat 3, with a circular movement instead of a to and fro.

6.—Repeat 4, with a circular movement instead of a to and fro.

NOTE.—It will be seen that most of the exercises with Dowd's machine are chiefly the previous exercises performed without apparatus. The machine simply is an accurate means of adding increasing resistance by putting more weights on to the carrier. The same remarks apply chiefly more or less to all the developing machines hereafter mentioned.

SERIES M.—EXERCISES WITH A SINGLE
DOWD'S MACHINE, THE ROPE PASS-
ING UNDER A PULLEY ATTACHED TO
THE FLOOR. (FACE TO MACHINE.)

1.—Right arm obliquely in front holding handle. Raise to the vertical by side of head without bending arm.



FIG. 77.

2.—Left arm ditto.

3.—Both grasping handle at same time:

4.—Right arm obliquely in front, raise forearm as far as possible without moving upper arm.



FIG. 78.

5.—Left arm ditto.

6.—Both together ditto.

7.—Right arm obliquely in front grasping handle, is carried backwards as far as possible, and allowed to return to original position.

8.—Left arm ditto.

9.—Both together ditto.



FIG. 79.



FIG. 80.

10.—Arms straight out in front, both hands grasping handle, body bent forwards as far as possible, is raised and carried backwards as far as possible, arms remain straight.

11.—The first two flat-foot exercises are performed facing machine, with both hands grasping handle.

SERIES N.—WITH SINGLE DOWD AS FOR SERIES M, BUT INSTEAD OF A HANDLE THE ROPE IS FIXED TO A STRAP WHICH IS FASTENED TO EACH FOOT IN TURN. (FOR RIGHT FOOT.)

1.—Facing machine, right hand resting on back of a chair, leg straight is

alternately carried forwards and backwards.

2.—Similar exercise with back to machine.



FIG. 81.



FIG. 82.



FIG. 83.

3.—Facing machine, right hand resting on back of chair, leg is brought from being in a line with left as high up as possible by bending the knee. Thigh remains immovable.

4.—Right side towards machine, right hand on back of chair, the right leg is alternately in front of left as far as possible to left, and returned to original position. (Fig. 86.)

5.—Left side towards machine, the right hand on back of a chair, the right leg is carried from contact with the left as far out as possible.



FIG. 84.

6.—Right side to machine, left hand on back of a chair, right leg held obliquely outwards towards the machine, thigh immovable, the right knee is bent until the foot touches the left leg. (Fig. 87.)

7.—Patient seated right side to the machine, the left foot is alternately turned outwards and allowed to recover.



FIG. 85.

8.—Reverse exercise by turning left side to machine. (Fig. 85.)

9.—Same as 1 reversed.

10. ,, 2 ,,

11. ,, 3 ,,

12.—Same as 4 reversed.

13. " 5 "

14. " 6 "

15. " 7 "

16. " 8 "



FIG. 86.



FIG. 87.

EXERCISES FOR THE MEDICAL GYMNASIUM.

NOTE.—Any of the exercises for Dowd's machine may be performed with any of the modifications of it. Thus the high Dowds may be used in the same way, where it is required to develop especially the lower part of the chest to help the latissimus dorsi and the lower part of the serratus magnus, trapezius, pectorals, &c., in their elevating action on the lower ribs.

The Quarter-circle Dowd will be espe-

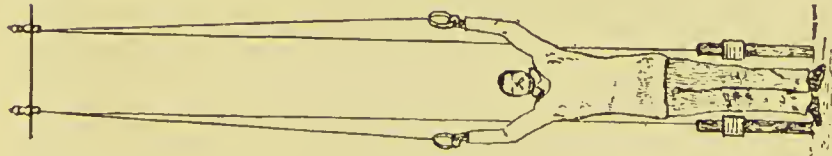


FIG. 88. The High Dowd.

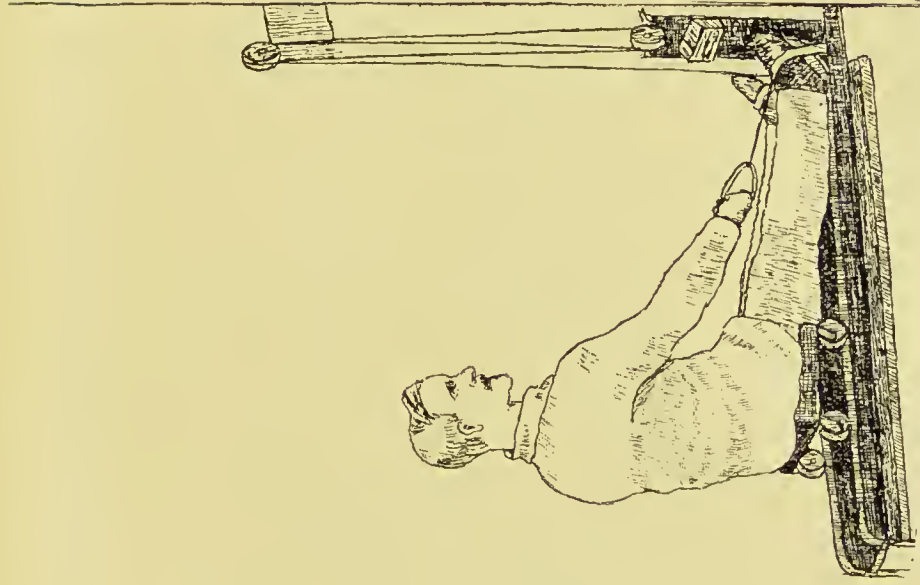


FIG. 90. The Rowing Machine.

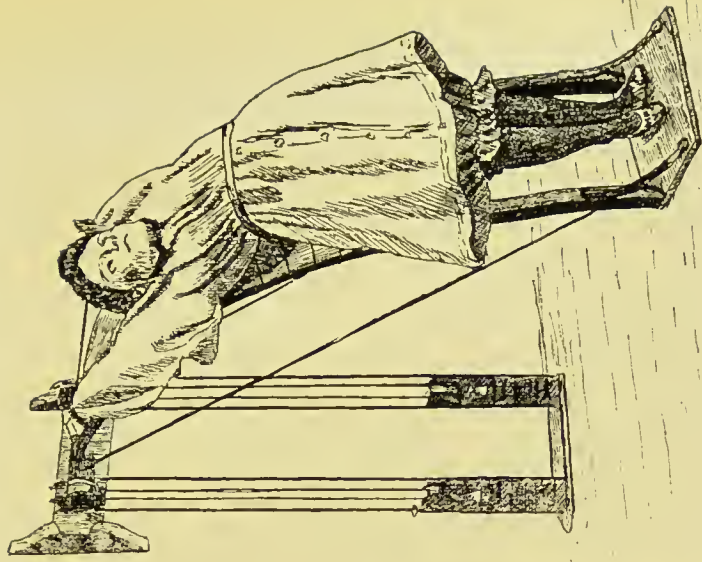


FIG. 89. The Quarter Circle Machine.



cially useful in stooping, and posterior curves of the spine.

The rowing machine is a very powerful combination of all the Dowds, only to be used towards the end of the course. It exercises practically all the muscles of the body.

The roller machines for exercising the finger, wrist and forearm muscles, can be usefully employed between more powerful exercises. And the same applies to the pronation and supination machine, and to the gymnastic chair which exercises chiefly the quadriceps extensor of the knee.

SERIES O.—WHEEL EXERCISES.

1.—Patient standing with back to wheel, arms out in a cross grasping the projecting pegs. See-saw action, to and fro. Increase resistance according to the patient's strength.

2.—Right side to machine, left hand on left hip, right hand grasping peg at summit of circle, right foot forwards, spine stiff. Right hand turns wheel from above downwards.

3.—Same, left foot forward.

4.—Same as 2, reversed.

5.—Same as 3, reversed.

6.—Right side to machine, feet together, right hand grasping lowest peg, left hand passing over head grasps highest peg, right hand to move forwards, left hand backwards.

7.—Same reversed.

EXTENSION EXERCISES FOR ACTING
CHIEFLY ON THE SPINAL LIGAMENTS.

SERIES P, 1. — *Oblique ladder.*—

Patient on back, feet on lowest two rungs, hands on highest rungs he can reach. Raise feet to the rungs of next level, the hands bearing the weight meanwhile. Remove the feet from rungs for a few seconds so that hands bear all the weight. Raise feet to next level and so on until the top is reached. Come down in reverse order.

2.—Ditto, with right arm always one rung above the left.

3.—Ditto, with left arm always one rung above the right.



FIG. 01. The Wheel Exercise, First Position.



FIG. 92. The Wheel Exercise, Second Position

SERIES Q.—EXERCISES WITH PARALLEL RINGS.

1. — Patient stands between rings, which are suspended about a foot above his head, and, keeping feet fixed as a pivot, performs a circular movement of the whole body, from right forwards to left ; from left backwards to right.

2. — The rings may be gradually lowered.

3. — Right ring may be a few inches higher than the left.

4. — Left ring may be a few inches higher than the right.

SERIES R.—VERTICAL POLE OR ROPE.

NOTE. — This exercise is best performed with the pole or rope rigid or suspended against a wall.

1. — Patient standing with back to pole, the hands above head, grasps the pole as high as possible ; then raising the heels from the ground, the patient endeavours with one hand at a time, to grasp the pole just above the other hand. The patient then allows the

hands to bear the weight in endeavouring to get the heels again on to the ground.

2.—Same exercise, right hand always higher.

3.—Same exercise, left hand always higher.

SERIES S.—TRAPEZE OR PARALLEL
RINGS.

1. — Patient standing on a stool, trapeze at such a height that the patient can just reach it with hands above head. Patient grasps trapeze, stool is removed, and patient swings backwards and forwards by alternately flexing and extending his legs.

SERIES T. — VERTICAL LADDER OR
GRIDIRON.

1.—Same as Series P, 1.

2.—Same as Series P, 2.

3.—Same as Series P, 3.

4 — Right foot on one of the lower rungs, right hand on one of the upper, so that the right side of the body forms



FIG. 93. Exercise with Parallel Rings.



a concavity towards the ladder. Alternately stretch left arm and left leg as far to the left as possible, and allow them to return to the hanging position.

5.—Ditto reversed.

6.—Climb with back to ladder using only left hand, right carrying a weight.

7.—Same, with face to the ladder.

8.—Same as 6, left hand carrying a weight.

9.—Same as 7, left hand carrying a weight.

SERIES V.—DUMB-BELLS.

NOTE.—The efficacy of most of the exercises from A to F can be increased by the use of dumb-bells from half a pound to five pounds in weight.

1.—Holding dumb-bell of five pounds or more at level of shoulder in right hand. Alternately raise and lower.

2.—Ditto with left hand.

SERIES W.

1.—Alternately raise above head and lower a heavy steel bar, using both

hands. The patient should fix his eyes on the centre of the bar.

SERIES X.—FOR BOW LEGS.

1.—Patient standing with legs a few inches apart, endeavours firmly to *internal* rotate the knees, holds them in this position a few seconds and then relaxes his muscles. He must not move his feet from the ground, or bend his knees in this exercise.

SERIES Y.—FOR KNOCK-KNEE.

1.—Same as above except that the movement is one of *external* rotation, with slight bending of the knee. Young children may be taught this movement lying down at first, simply rotating the whole leg and foot out. When they have learnt this, the foot can be fixed by an assistant, and the same movement attempted.

CHAPTER VI.

GENERAL TREATMENT.

Medicinal and Dietetic Treatment — Prophylaxis at School—Hygiene—Maintenance of Correct Positions—Over Fatigue—Prescription of the Exercises—Age for Cure—Length of Treatment — The Gymnastic Master—Influence of Various Games, and Method of Modification necessary if used during Treatment—Whip-top—Cricket—Golf—Hockey—Football—Tennis—Badminton — Bowls — Fencing — Sculling — Swimming—Bicycling—Horse Riding.

THE treatment previously discussed has been chiefly mechanical, that is, directed to overcoming the deformity. Important however, as is the mechanical the general treatment must equally engage our attention, if we wish to bring our efforts to a successful issue.

In improving the deformity by the use of muscular exercises, we also inci-

dentally bring about an usually very great improvement in the general health. So much is this the case, that very many practitioners are now in the habit of prescribing a course of medical movements or gymnastics for the cure of very many conditions of depressed vitality. It is important, however, that the exact cause of the depressed vitality should be accurately made out and treated. Thus if dyspepsia were the cause, it would obviously be better to investigate its etiology than to trust to its accidental cure by the gymnastics. Frequently the dyspepsia of young curvature patients is due to a deficiency in the teeth, to errors or fads of diet, or to insufficient clothing. In these cases the improvement caused by the movements would not be permanent, unless the cause of the dyspepsia were at the same time removed. Again, anæmia is improved by gentle exercise, but how much more is the improvement if iron is given at the same time. Constipation and menorrhagia in the same way will

require additional treatment. The latter condition is very frequently found to accompany spinal deviations, and is probably due to a lax condition of the vessels, similar to a lax condition of the muscles. Each menstrual period so lowers the patient that much of the health gained in each month is lost again. It is, too, a symptom which the patient or her friends very frequently omit to mention. The writer has found that most of these cases are greatly relieved or cured by a six weeks' course of ergotine pills, containing 2 grs. of ergotine each and given thrice daily.

When the main symptom is weakness, especially in the overgrown, such combination of lime and phosphorus as the syrup of the hypophosphites, would recommend itself on theoretical grounds. Much attention must be paid to the diet of the patient, more especially in enjoining a rest after meals.

As curvatures develop at the growing period, they often have an important bearing on school life, and the surgeon

has frequently to decide between conflicting interests. Before a curvature is apparent, there is, as has been pointed out, some previous depression of the general health. If this were only noticed in time, and treated, there would, in most cases, be no curvature at all. To detect this early, the writer very strongly advocates the periodical inspection of schools, either by a medical officer of health, or by some specialist in this matter. If, in addition, the pupils are weighed every fortnight, and a record of the weight and height kept, and compared every month with books recording illnesses and work done by the pupil, early intimation of depressed health would be obtained. Thus, if a boy were found to be losing weight at the same time that he did less work, there would obviously be a reason for calling in a doctor to investigate the cause. If the child were found to lose weight at school, or to gain less at school than at home for the holidays, there would obviously seem to be some

adverse condition at the school which required removal.

The writer would suggest that the inspection of the school should include, not only the pupils, but the class-rooms, bed-rooms, cooking and sanitary arrangements. Then every possible precaution would have been taken to insure the safety of the child's health, and the early detection of overwork, illness or its causes.

An inspection such as this, properly conducted would probably be welcomed by most teachers, and could not but increase the confidence the parents repose in them. The teachers would receive valuable advice upon lighting and ventilation, upon proper and improper seats and desks and the proper position of these as regards the source of light upon the avoidance of strain upon the eyes or upon the fingers in writing, and they would receive information of the latest improvements in school administration, and school appliances. Thus the possibility of a curvature commencing at school would be almost removed.

When a curvature has developed at school, the doctor has often to decide whether the child shall be retained or removed. The writer always advises that the child be retained at school, but that the amount of work be cut down to a minimum. In this way, the child will retain the healthy influence of school life, and the necessary treatment may at the same time be proceeded with. If there has been a deficient amount of light, the deficiency should at once be removed. The exercises prescribed should take place at the most suitable time, and no lessons should be allowed to interfere with them. The best time for the exercises is in the morning, between from an hour after breakfast to an hour before lunch. There should always be a rest of half an hour after the exercises before the next meal is taken. If breakfast is at 8 a.m. and dinner at 1 p.m., the exercises are best done about 11.30 a.m., and at 11 a.m. the patient should have some beef tea or milk.

A large amount of fresh air is essential, and many hours daily should be spent out of doors. It need hardly be pointed out that the patients must not suddenly be condemned to walking for eight hours a day. In warm weather they may have several short walks or out-door games with intervals, or rests on chairs, or lounges in a garden. In winter they may rest indoors with the window open, but with their outdoor clothes on. If cold, a rug round their knees may be added. Special attention should be paid to the ventilation of their sleeping apartments. The patient should go to bed early to avoid hot, gas-lighted rooms. Thus a healthy colour will come to their complexions just as surely as the chlorophyll will develop in the potato plant when moved out of the cellars into the light.

If the patient suffers from any defects of vision, these must of course be corrected by properly prescribed spectacles, and the desk or book must be raised to enable the patient to write or read with-

out stooping. If however, the habit of stooping has been acquired before the visual defect has been remedied, the habit is often found to continue after the acquisition of the correcting spectacles unless special supervision is for a time given.

If the legs are found to be of a different length, this too must be first corrected by thickening the shoe on the shorter side. Fig. 8 represents a boy whose right leg is one inch longer than the left. He suffered for more than a year from necrosis of the right tibia, and lost large portions of the shaft of the bone. The new bone not having to bear any weight during its growth, grew more quickly than the left, which though aided by crutches, for many months bore the whole weight of the body. By thickening the left sole to nearly an inch in excess of the right, his spine became perfectly straight. In this case there was a true lateral curvature only. The same good result would not have taken place had the deformity remained for a

long time uncorrected. Rotatory changes would have taken place. At least, that is the author's experience from an examination of cases of curvature following shortening from hip joint disease. This is the only case in which the writer has been able to completely obliterate a curvature by thickening the sole of a boot where the limbs have been unequal in length. He is of opinion that cases in which such simple treatment alone suffices are of extreme rarity, notwithstanding the frequency with which this fact is mentioned in works on general surgery.

Flat-foot should always be fully corrected by suitable pads, of which preference should be given to those which contain elastic springs. These pads, which are to prevent over stretching of the weak muscles and ligaments which support the arch of the foot, should be always worn both in outdoor and indoor shoes or boots. The same result is attained by thickening the inner border of the boot by $\frac{1}{4}$ to $\frac{1}{3}$ of

an inch; the thickening gradually shading off as it approaches the outer border. Thus a section of the sole would be wedge-shaped. If knock-knee exists it should have the suitable exercises prescribed for it, and the correction of the flat-foot will have done a great deal towards its cure.

Parents, teachers, and all those who have to look after these patients, should ever be on the look-out to see that their charges do not get over tired. Over fatigue causes the assumption of bad positions, and interferes with muscle development. Standing and stooping being causes of scoliosis, should, if possible, be entirely avoided. If standing is necessary, it should always be with the feet two or three inches apart. The stooping should be removed by constantly directing the patient's attention to remedying it, in the manner and with the restrictions previously explained, and by seeing that the clothes are loose enough in front. The patient should acquire the habit of frequently standing

with the heels against the wainscot, and flattening himself against the wall so that the shoulders and head touch it. Then he should try to keep this corrected position while he walks about, returning to the wall occasionally to correct any deviation from it. Further, by having mirrors placed in suitable positions, the patient will be able to constantly correct the unequal heights of the shoulders, and bring them level again. (Roth.) The patient should sit only in straight-backed chairs, and with the back against the back of the chair. The knees should be slightly separated and the feet rest comfortably on the ground or on a footstool, if the chair is too high. For meals or for writing the chair should be pushed under the table as much as possible. For writing the paper should be raised on a sloping desk, and for piano playing the back should be supported and the elbows touch, or nearly touch, the back of the chair. Patients should never sit cross-legged, as this produces a curve of the

spine. Rest is best taken in a straight-backed chair, or in one the back of which makes an angle of 130° or 135° , with the seat. In any case rest in the daytime should not be prolonged beyond an hour. Too much rest retards the regaining of muscular tone. With a little trouble it is generally possible to find out what are the bad positions which the patient is in the habit of frequently assuming. If on investigation these are such as are likely to increase the deformity, the patient must be induced to discontinue them, or what is often easier, to reverse them. If, for instance, the patient is in the habit of always crossing the left leg over the right, he may as a compromise cross the right over the left. Not to cross at all is frequently described as too irksome at first.

With regard to the exercises which have been given in detail in the previous chapter, the very greatest care must be taken in prescribing them. While they have been arranged as far as possible in

a graduated series, the necessity for classifying them has to an extent interfered with this. Thus the "swimming" exercise, one requiring a great amount of exertion, is placed amongst those requiring very little. For the first week or so only exercises requiring little muscular exertion are to be ordered, and these should at first be done passively. Gradually more exercises are added and actively performed. In the next stage the patient passes on to Dowd's machine without weights. Gradually these are added, either equally or unequally, according to the requirements of each individual case.

In every case a definite prescription of the exercises to be performed should be given in writing, and as the new exercises are ordered these too should be in writing. We have shown how very powerful are the effects of these gentle exercises on spinal curves, and one cannot therefore be too careful or accurate in their prescription. Nothing should be left to chance.

When the patient is deemed strong enough, exercises with the various gymnastic apparatus may be ordered. In all these, however, the effect of each exercise on the special deformity must be carefully thought out. The special exercises should therefore be prescribed for each case in the same way as certain drugs are prescribed for each case of dyspepsia. A stock mixture cures a certain number, makes a certain number worse, or has no effect. Success is greatest to him who knows best how to vary his prescriptions and instructions for general mode of life, to each case. It is exactly the same when gymnastics are the chief means of cure instead of drugs. Thus, in climbing ladders or the "grid-iron," the principle of correcting the deformity as much as possible should be borne in mind, and the arm of the backward side should proceed up the ladder a rung above the forward one, and the leg on the side of the lumbar convexity should, if possible, keep a rung above the one on the opposite side, *i.e.*, the side of the protruding hip.

The cure of a spinal deviation may be commenced at any age, at any rate as soon as the child has sufficient intelligence to do as it is bid. With very young children the use of Dowd's machine and the other gymnastic apparatus is out of the question. Cure must then be effected by means of table work, *i.e.*, the "home-exercises." Cure is fairly easy up to 35 or 40 years of age, but the time the curve has existed untreated is an important element in prognosis. After 40, the tissues have lost a large amount of their pliability and cure is more difficult. After 40, too, patients often lack the energy necessary to undergo a cure, and prefer some sort of apparatus.

The length of time during which a patient should be under treatment varies considerably, and it is often impossible at the commencement to give even an approximate idea. Some cases are so slight that a month of treatment is sufficient. Figs. 31, 32, 35, 36 represent such cases before and after six weeks

of daily exercises. Most cases require three months, and others six. A few very bad cases take a year, or even more. These periods, however, compare very favourably with the length of treatment by instruments alone. The length of treatment is much shorter if the patient is a boy, if the surgeon has the active co-operation of the patient and his friends, if the exercises are done daily, if carried out under a competent gymnastic master, if there is an active and intelligent interest shown by the supervising surgeon, and if no intercurrent malady occurs to break the continuity of the treatment.

The treatment is longer for girls, because they must omit the exercises for at least four days a month, or for a longer time if there are disorders of menstruation. It is longer, too, if other things, such as school, late hours, holidays, &c., are allowed to interfere with the course.

Relapse rarely occurs when once cure is obtained, unless the original causes

of the deformity are again allowed scope. For some time after cure has taken place, the patient should continue a course of exercises at home, either with dumb-bells or with a Dowd's machine. Even when quite cured, the patient should be re-examined at intervals of two or three months. It should always be remembered that a patient once cured is not thereby insured from a recurrence of the disease, if the conditions which caused it are again allowed to act.

Unless the surgeon has much time at his disposal a gymnastic master is a necessity, and happy is the surgeon who has one he can trust. It is essential that both should be pulling together, or failure will result. The following is the procedure recommended and adopted by the author. Before the patient has the first lesson the surgeon should see the gymnastic master, and carefully explain the case to him, giving him in writing, short notes of the deformity, pointing out the exact distortion, the muscles weak or lengthened, and

explaining the treatment to be adopted for the first month. If possible the surgeon should be present for the first lesson, and after that should from time to time pay "surprise" visits, more especially towards the end of the lesson, to see that the patient has not been overtired. No new exercises should be given without the consent of the supervising surgeon. At the end of a month the surgeon takes fresh graphic records, again sees the gymnastic master, and pointing out the changes produced by the treatment, makes such alterations in the exercises, length of the lessons, &c., as he may consider necessary.

In connection with treatment, it may be of interest to discuss very shortly the influence of various games on curvatures. Games undoubtedly have an influence in the formation of spinal deviations, so much so that many—though forms of muscular exercise—have to be prohibited, or at least modified for curvature patients. Most games are more or less right-sided



FIG. 94. To show Effect on Spine of Writing at too Low a Table (exaggerated).

ones, tending to draw back the right arm and by excessive use of the right arm to produce a convex right dorsal curvature. Nevertheless, by making these games left-handed instead of right-handed, many of them may be rendered not only not injurious, but useful adjuncts to ordinary treatment. There is, however, one other drawback to many games, namely, that they tend to produce a kyphotic condition of the spine. As stooping has been shown to be a cause of curvature, this must always be borne in mind in permitting or prohibiting this or that special game.

From watching boys playing at whip-top in the street and elsewhere, the writer has been struck with the possibility of this game being useful in certain forms of curvature. Whether the game be one of "races" or "encounters" the object of the player is to make the top go as quickly as possible. Though skill counts for something, strength is more useful. The harder the top is whipped the

faster it goes. Commencing with gentle to and fro whips, the player whips harder and harder, until a very forcible rotatory movement of the upper part of the body takes place with each blow. The rotatory movement is of the right shoulder forwards, and the left backwards.

Suppose this exercise to be indulged in very largely in excess of any other, then, as in the case of the blacksmith's arm, a convexity in the right dorsal region with rotation forwards of the right shoulder would occur. Consequently if this were the original deformity, whip-top playing with the left arm would be a corrective exercise. Or again, a right dorsal concavity with right shoulder backwards would be benefited by right-handed top-whipping. Unfortunately for the pastime, the two above combinations of deformity are uncommon.

Batting at cricket has a tendency to rotate the spine so as to bring the right shoulder forward, but it also gives con-

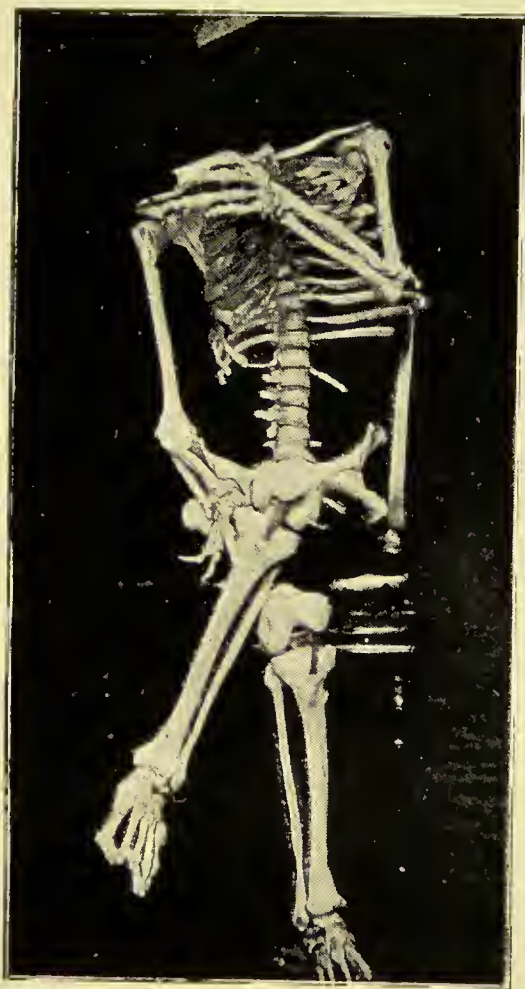


FIG. 95. To show Rotation of Spine from Sitting Cross Legged (exaggerated).

siderable exercise to the left arm, in batting, at any rate. In fielding there will naturally be a tendency to assume bad positions unless the fielder is in a position where balls frequently come. Bowling exercises a very large number of muscles, but it is of course another instance of a one-sided exercise.

Golf again, has the same tendency to rotate the right shoulder forwards. The left arm, however, comes in for such an amount of exercise in using the club as is sufficient to prevent a lateral curvature. In "putting" a good deal of stooping is necessary. This, however, is harmless if the player is careful to assume an erect position when the putting is done. The variety in the different actions in the game, interspersed with the gentle walking exercise in open spaces which the game entails, makes golf an ideal form of exercise for those for whom greater feats of strength are undesirable.

Hockey is really a more violent form of golf in which the rests are shorter and

fewer. Patients with right dorsal convexities should play hockey left-handed if they are strong enough to indulge in the game at all.

Football is hardly a game for persons with spinal curvature. This is unfortunate, because it is practically a symmetrical exercise, the only asymmetrical part being the kicking which is always done with the right leg. The Association game is even more symmetrical as the left leg takes almost equal share with the right in the game. Both forms are, however, far too violent forms of exercise for persons with weak muscles, weak bones, and weak ligaments.

Fives, rackets, tennis, and Badminton, are all right arm exercises with a tendency to form right dorsal convexities. By using the left arm instead of the right, this deformity, if present, may be very much improved. For patients who for any reason cannot go to a gymnasium, the writer has long been in the habit of prescribing left-handed Badminton.

This can easily be played in any fair-sized room over a piece of tape or string fixed from one wall to another, or even from one chair to another. The writer can speak highly of it as a very useful form of corrective exercise.

Bowls, quoits, skittles, all right-handed games, may too be useful if reversed.

Fencing is an excellent exercise, conducing not only to the cultivation of a correct attitude in standing, but it also conduces to rapidity of motion, decision, and steadiness of nerve. It should be of great use in those of feeble muscular development in which a curve has not yet appeared. The pupil should, however, be taught to fence equally well with either right or left arm.

Sculling is a good symmetrical exercise for those who have been previously strengthened by a course of medical exercises. It is, however, an exercise to be indulged in moderately and care must be taken that it is done properly, or there is a tendency for sculling to produce kyphosis. Rowing with a single

oar tends to produce a dorsal convexity on the side away from that on which the oar is used. This was notoriously the case with the slaves on the Triremes of Ancient Rome.

Swimming, when the breast stroke is used, is also a good exercise towards the end of a course of treatment. Not only does the bathing have a good tonic effect on the system, but the exercise is a good corrective one, tending among other good effects to counteract the kyphosis.

Before concluding the subject of the influence of the various games, a word or two must be said about bicycling. There can be no doubt, that for most young persons bicycling under certain conditions is an ideal form of exercise. It is at once a pleasant pastime, and is a perfect form of symmetrical exercise. It is ideal, because it can be made to combine change of scene and outdoor life with a minimum of exertion. For those engaged in educational excesses or in mental work, it forms a more or



FIG. 96. Effect on Spine of "Scorcher's" attitude.

less efficient corrective, giving a maximum of fresh air, with sufficient exercise in a comparatively short time. There are however, certain necessary conditions to fulfil in order to ensure this very beneficial result. The muscles should have attained a certain degree of development, or if not, the cycling should be used most gradually until this degree of development has been reached. At first the cyclist should never ride until he or she is out of breath. On the first symptoms of breathlessness the cyclist should dismount and rest. The amount done per day should be very strictly limited at first. Thus the muscles and the circulation will be gradually strengthened, and the over-strain and cardiac dilation will be avoided. In following this rule the cyclist will soon find that the distance traversed before breathlessness occurs, rapidly increases, until it gradually recedes into the dim distance. It is very important too that the cycle should not be too heavy. Many of the bicycles

sold, especially ladies' cycles, are far too heavy and the writer has seen bicycles weighing nearly 40 lbs. being ridden by quite young girls. The maximum weight for an adult of not more than 12 stone should be 30 lbs., and very much less if the rider's weight be under 8 stone. Under no circumstances should boys and girls ride bicycles made for adults, not only on account of the weight, but also because of the possibility of strain or injury to internal organs. Young people should never ride hills of any length or magnitude, and with regard to the distance travelled, they should never cycle more than three times the distance they would be able to walk. The rate too, should not exceed seven or eight miles an hour. The position of the saddle is of the utmost importance. The saddle should be comfortable, should not be small, and should never give rise to "saddle soreness." It is impossible to recommend any special saddle, each rider must find out for



FIG. 97. Effect on Spine of having the Handles of the Bicycle too far forward.

himself the saddle which for him fulfils these conditions. Generally a narrow peak with a broad seat will be best.

The "cyclist's back," which is a kyphosis of lumbar and dorsal vertebræ, is caused by having the saddle too far back and the handles too low. The saddle and handles should be in such a position that the attitude of greatest comfort is the erect position with the spine showing its normal curves. This is mostly insured by the handle bars being on a level with the hip-joints, *i.e.*, about two inches higher than the saddle, and by the handle ends reaching to the junction of the lower one-fourth of the femurs with their upper three-fourths. Cycling should not be indulged in soon after a meal, nor for females at those periods when much exercise is generally forbidden.

Recently, in the *Medical Annual* of 1897, Dr. Otto Kiliani has recommended sloping the seat and raising one handle bar as a means of curing scoliotic deviations, and has given figures showing the

effect of these alterations. It is to be noted, however, that the photographs are necessarily taken with the patient at rest. Cycling being a symmetrical exercise, it seems reasonable to suppose that, when in motion, the correction tends to take place automatically if the above instructions are accurately carried out.

For a pure kyphosis, the saddle should be brought nearer the handles, and for a pure lordosis further away.

For girls horse-riding is an asymmetrical exercise tending to cause a scoliosis with the right shoulder backwards. For very feeble patients it is undoubtedly too severe a form of exercise, and it has besides a tendency to cause a bowing backward in the lumbar region. As the muscles become developed riding on the off side may be allowed for the subjects of a right scoliosis. Patients of feeble muscular development, if they ride at all, should ride alternately on the near and off side.

In the foregoing remarks the writer

would not wish to be understood as recommending or depreciating any of the above recreations for *healthy* persons. The observations are only meant to point out those which are unsuitable for curvature patients, and how others must be modified if they are permitted at all to those who are under treatment for spinal deviations.

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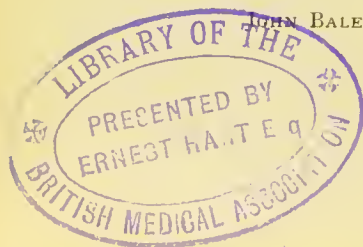
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